

STORNO RADIOCOMMUNICATION



MOBILE RADIOTELEPHONE
MODEL STORNOPHONE 600
TYPE CQM661
TYPE CQM662
TYPE CQM663
420...470Mc/s

Storno

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GENERAL SPECIFICATIONS

Type	CQM661	CQM662	CQM663
Frequency range	420-470 MHz	420-470 MHz	420-470 MHz
Min. channel spacing	50 kHz	25 kHz	20 kHz
Max. frequency deviation	± 15 kHz	± 5 kHz	± 4 kHz
Frequency stability	Conforms with Government Regulations		
Max. bandwidth	1000 kHz		
Antenna impedance	50 Ω nominal		
Number of RF channels	Max. 12		
Dimensions Transmitter/receiver	340 x 190 x 85 mm (13 1/3" x 7 1/2" x 3 3/4")		
Dimensions Control box CB601	140 x 150 x 50 mm (5 1/2" x 6" x 2")		
Weight, transmitter/ receiver	5, 2 kg (11, 5 lbs.)		
Weight, control box CB601	0, 6 kg (1, 3 lbs.)		

TRANSMITTER SPECIFICATIONS

RF-output power	6 watt with possibility of reduction to lower output power
Modulation	Phase modulation 300-3000 Hz
FM noise	CQM661: 50 dB below stand. test modulation CQM662, CQM663: 40 dB below stand. test modulation
Spurious and Harmonic radiation	Below 2×10^{-7} watts

RECEIVER SPECIFICATIONS

Sensitivity	0, 4 μV at 20 dB S/N ratio
Squelch	Electronic, adjustable
Adjacent channel selectivity	85 dB (EIA-to-signal method)
Spurious radiation	Less than 2×10^{-9} watts
Intermodulation	60 dB (EIA)
Image and spurious attenuation	75 dB
AF-output power	2 watts, adjustable

POWER SUPPLY SPECIFICATIONS

Battery voltage	6.3 V	12.6 V	25.2 V
Current consumption			
Stand-by	0.7 A	0.28 A	0.16 A
Transmit	8.8 A	3.6 A	1.7 A

CHAPTER I. GENERAL DESCRIPTION

A. Design Details

Introduction

The STORNOPHONE 600 mobile radiotelephone is a transmitter/receiver combination for simplex or duplex operated FM radio communication in one of the following frequency ranges: 68-88 Mc/s, 146-174 Mc/s, and 420-470 Mc/s.

The complete radiotelephone comprises a transmitter/receiver cabinet, a control box, a microphone or handset, and antenna and installation materials.

This manual contains a detailed description of the STORNOPHONE 600 and the standard ac-

cessories which are available. Because we at STORNO are constantly processing the experience we gain during the production, testing, and operation of our radiotelephones, minor modifications and corrections will be made regularly. These will be listed on a separate sheet, which will be placed first in this manual.

If your STORNOPHONE 600 is a special version, descriptions of the necessary modifications will be condensed into an appendix which is placed first in the standard description whilst the associated circuit diagrams are placed last in the book.



Chapter I. General Description

Standard Versions

The STORNOPHONE 600 is available in the following versions for either simplex or duplex operation:

Type	Frequency Range	Channel Separation
CQM611	146 - 174 MHz	50 kHz
CQM612	146 - 174 MHz	25 kHz
CQM613	146 - 174 MHz	20 kHz
CQM614	146 - 174 MHz	12.5 kHz
CQM631	68 - 88 MHz	50 kHz
CQM632	68 - 88 MHz	25 kHz
CQM633	68 - 88 MHz	20 kHz
CQM634	68 - 88 MHz	12.5 kHz
CQM661	420 - 470 MHz	50 kHz
CQM662	420 - 470 MHz	25 kHz
CQM663	420 - 470 MHz	20 kHz

Where it is not necessary to distinguish between radiotelephones with different channel separations, the following description will employ common designations for radiotelephones inside the same frequency band. Thus, the CQM611, CQM612, CQM613, and CQM614 2-metre radiotelephones will be covered under the common designation of CQM610.

The STORNOPHONE 600 can be operated from 6-, 12-, and 24-volt DC power supplies. The voltage changeover operation is performed outside the transmitter/receiver cabinet and is very easy to make. A maximum of 12 RF channels can be provided.

For 2- and 4-metres radiotelephones the transmitter power output is 10 watts, and for 0.7-metres radiotelephones 6 watts with provision for operation at reduced power.

Space is provided in the transmitter/receiver cabinet for an additional receiver converter for use in the maritime and similar services where larger bandwidth of the receiver input circuits is required.

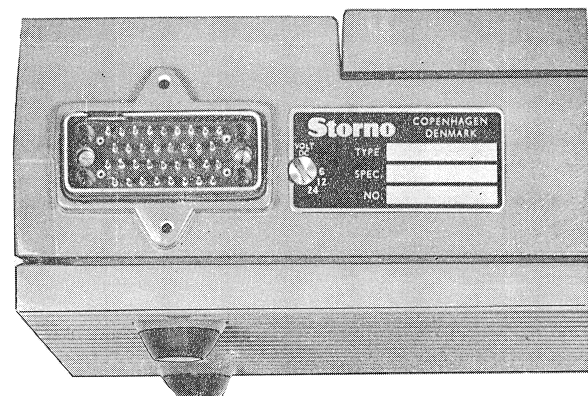
A comprehensive line of standard tone equipment makes it possible to add various forms of selective calling systems to the STORNOPHONE 600. The choice is not limited by the space available in the transmitter/receiver

cabinet as all tone equipment is designed for installation in the control box.

Construction

The transmitter/receiver equipment is housed in a die-cast cabinet which is both dust-proof and splash-proof. The lid and bottom of the cabinet are heavily fluted so that they can carry a maximum of heat away from the equipment. Inside, the cabinet is divided into three compartments; these accommodate the transmitter, receiver, and power supply sections. The transmitter section becomes accessible on removal of the lid of the cabinet whilst removal of the bottom plate permits direct access to the receiver section and the power supply section.

A multiwire connector on the cabinet provides connection for multiwire cable and battery cable, and a voltage switch on the side of the cabinet permits switching between battery voltages of 6, 12, and 24 volts.



Furthermore the cabinet of simplex operated radiotelephones has an antenna connector whereas the duplex versions have two antenna connectors which provide connections for both receiver and transmitter antennas or a branching filter.

Both the transmitter and the receiver consists of a number of modules built on printed wiring boards. These are screw-mounted side by side in the cabinet, with their components facing outwards. The power supply

Chapter I. General Description

section is an integral unit having only one wiring board, with its wiring side facing outwards. This unit, as well as the transmitter and receiver modules, are easily removable from

the cabinet; the only thing to do is to loosen the screws which hold the particular unit in place.

B. Control Equipment

The accessories listed below are available for use with the transmitter/receiver unit. They are grouped solely for practical reasons. For instance, there is nothing to prevent use of the watertight control box with the non-watertight handset.

Standard Control Equipment

This group of control equipment will normally be employed in passenger cars, in commercial vehicles, and in buses etc. where the equipment will not be directly exposed to moisture, so that watertight or particularly rugged construction is not a requirement.

- CB601. Control box of die-cast light-alloy metal with control knobs and lamps on the front panel. An LS601 loudspeaker (see below) can be fastened to the bottom of the box. A loudspeaker amplifier and various types of tone equipment can be installed. Mounting hardware is supplied with the box.
- LS601. High-efficiency loudspeaker. Mounting hardware is supplied.
- MC601. Fixed microphone with built-in amplifier. Mounting hardware is supplied.
- MC602. Fixed microphone with built-in amplifier and 10-cm gooseneck.
- MC603. Fixed microphone with built-in amplifier and 20-cm gooseneck.
- MC604. Fixed microphone with built-in amplifier and 40-cm gooseneck.
- MC606. Fist microphone with built-in amplifier, push-to-talk key, and hang-up bracket. Mounting hardware is supplied.
- MT601. Handset with built-in amplifier, push-to-talk key, and hang-up bracket. Mounting hardware is supplied.

- MT601. Handset with built-in amplifier, push-to-talk key, and hang-up bracket. Mounting hardware is supplied.

Watertight Control Equipment

This group of control equipment will normally be used in open vehicles, (lorries, fork lifts, tractors, etc.), in ships, and in locomotives etc.

This equipment is watertight and dusttight as well as corrosion-proof and saltwater-proof; it is also rugged and consequently will stand up to rough handling. The size and shape of the control knobs permit them to be operated by a person wearing working gloves. Lastly, this equipment is designed for use under conditions of high ambient noise.

- CB602. Watertight control box in grey die-cast light-alloy metal, with heavy-duty control knobs (military type). A loudspeaker amplifier and various types of tone equipment can be installed in the box. Mounting hardware is supplied.
- LS602. Watertight, saltwater-proof folded-horn loudspeaker.
- MT602. Watertight, impact-proof handset with built-in amplifier and transmit button. Normally, the MT602 handset is permanently connected to the control box but can be supplied with watertight plug if desired. A holder and mounting hardware are supplied.

Chapter I. General Description

Antennas

The STORNOPHONE 600 is designed for operation with a 50-ohm antenna. STORNO can supply the following standard types, all of which have bases designed to permit mounting from the outside without damaging the car upholstery.

- AN39-5 1/4 wavelength whip antenna for the frequency range 68-88 MHz.
- AN19-5 1/4 wavelength whip antenna for the frequency range 146-174 MHz.
- AN69-3 1/4 wavelength whip antenna for the frequency range 420-470 MHz.
- AN69-4 5/8 wavelength whip antenna for the frequency range 420-470 MHz.

Other types, such as a 5/8-wavelength rear-mounting antenna, tilt-over antenna or magnetic antenna may be used if desired.

Branching Filters

The branching filters specified below are used with radiotelephones for duplex operation, when the transmitter and the receiver are to be connected to the same antenna.

The filter is housed in a die-cast cabinet similar to that of the transmitter/receiver. It can be mounted either on top of the transmitter/receiver cabinet, for which purpose mounting hardware is supplied, or separately by means of an installation kit No. 37.065 (see under Installation Kit).

- BF632 Branching filter for the frequency range 68-88 MHz.
- BF612 Branching filter for the frequency range 146-174 MHz.
- BF662 Branching filter for the frequency range 420-470 MHz.

Installation Kit

In addition to a number of the accessories listed above, the installation of a STORNOPHONE 600 radiotelephone requires a kit of parts. These are specified below:

- 17.014 Standard kit of accessories consisting of multiwire connector for control

cable, antenna connector, fuse holder and set of cable shoes for battery cable.

- 19.063 Standard installation kit consisting of 6 metres of multi-core cable, 8 metres of battery cable, and 4 metres of antenna cable. These lengths are sufficient for installing a radiotelephone, even in large vehicles.

Also available are:

- 37.065 Mounting plate with hardware and screws for mounting the transmitter/receiver cabinet or a branching filter.
- 37.072 Mounting strap with hardware and screws for mounting the transmitter/receiver cabinet.

Tone Equipment

The STORNOPHONE 600 has provision for subsequent addition of tone equipment. The installation job is simple, space for a tone transmitter and a tone receiver having been provided in the control box. Additional space for an alarm circuit is also available in the control box.

If the STORNOPHONE 600 is supplied with tone equipment, you will find descriptions, circuit diagrams etc. of such equipment in a separate technical manual.

Installation Instructions

Brief installation instructions are supplied with each individual accessory. However, Chapter 4 of this manual contains a complete description of how to install both the transmitter/receiver cabinet and the accessories.

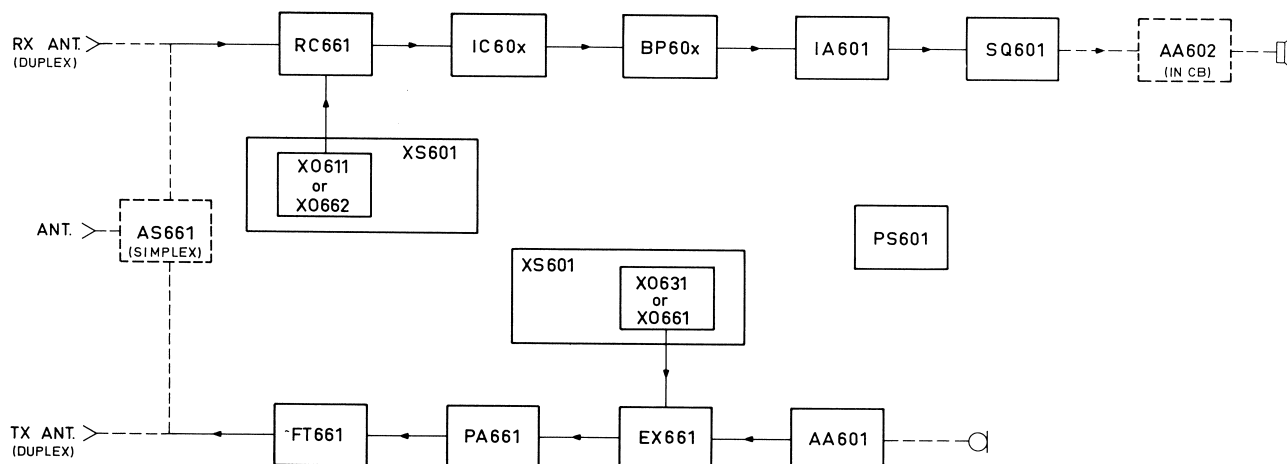
Otherwise, STORNO will be glad to supply all such information as cannot be obtained by a study of this manual.

Operation

A booklet containing very detailed operating instructions is supplied with the STORNOPHONE 600. Accordingly, this manual contains no operating instructions.

CHAPTER II. THEORETICAL CIRCUIT ANALYSIS

A. General Description 420-470 Mc/s Equipment



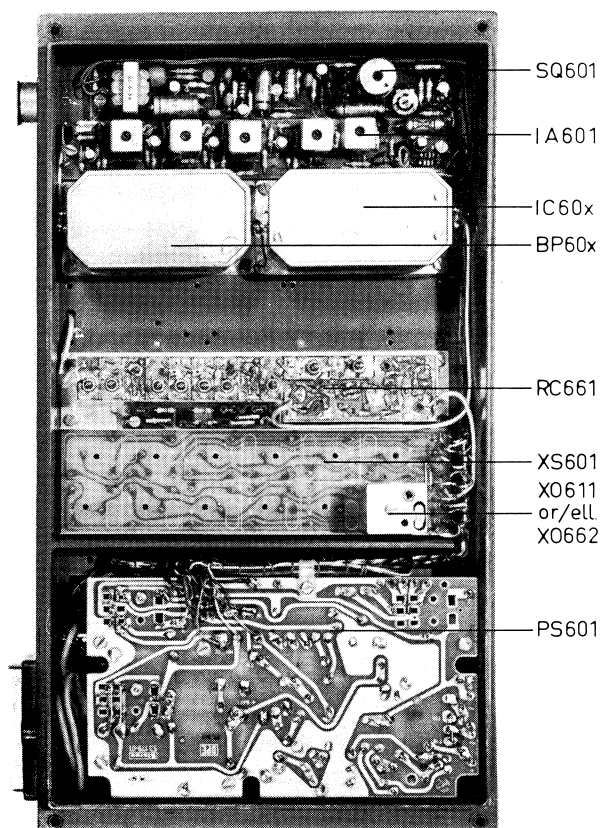
Both the receiver and the transmitter are divided into a number of subunits each of which is built on printed wiring boards. This division has been made in order to make the equipment easily accessible for adjustments and repairs, and follows strictly logical lines.

The receiver and the transmitter use silicon transistors throughout, resulting in less dependence on ambient temperature and in greater reliability.

Receiver Section

The receiver is a double-conversion super-heterodyne using intermediate frequencies of 10.7 Mc/s and 455 kc/s. The necessary selectivity is obtained by means of two block filters. A maximum of 12 crystal oscillators - one for each frequency channel - can be provided. The receiver is composed of the following modules:

Receiver converter with RF amplifier and 1st mixer	RC661
Crystal oscillator (1-12 pcs.) for either 50kc/s or 25/20kc/s channel separation	XO611 (50kc/s) or XO662 (25/20kc/s)



Chapter II. Theoretical Circuit Analysis

Intermediate-frequency converter with 10.7 Mc/s	IC601 (50kc/s)
crystal filter and 2nd mixer for 50kc/s, 25kcs, and 20 kc/s channel separation	or IC602 (25kc/s) or IC603 (20kc/s)
IF filter for 455 kc/s for either 50 kc/s or 25/20 kc/s channel separation	BP601 (50kc/s) or BP602 (25/20kc/s)
Intermediate-frequency amplifier, 455 kc/s	IA601
Squelch and audio amplifier unit	SQ601

The receiver moreover comprises an audio output amplifier unit, type AA602. However, this unit is located in the control box and will be described in connection with the latter.

Transmitter Section

The transmitter is covered by a screen shield which can easily be removed and inserted without use of any tool.

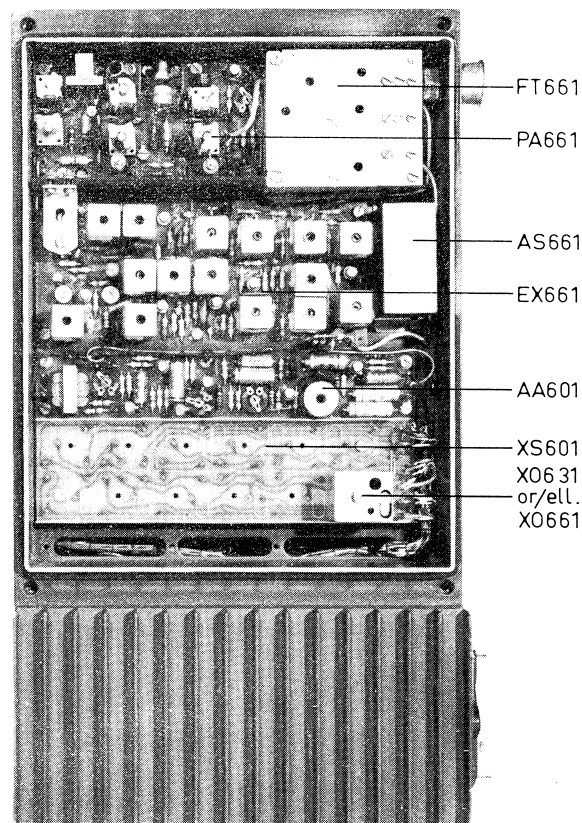
The transmitter is phase modulated. Its output frequency is 36 times the crystal oscillator frequency. Phase modulation is performed at the fundamental frequency. A maximum of 12 crystal oscillators - one for each frequency channel - can be provided. The transmitter is composed of the following subunits:

Audio amplifier for modulator	AA601
Crystal oscillator (1-12 pcs.) for either 50 kc/s or 25/20 kc/s channel separation	XO631 (50 kc/s) or XO661 (25/20kc/s)
Exciter with modulator	EX661
RF power amplifier	PA661
Frequency tripler	FT661

Common Units

Antenna shift unit (only used in radiotelephones for simplex operation)

AS661



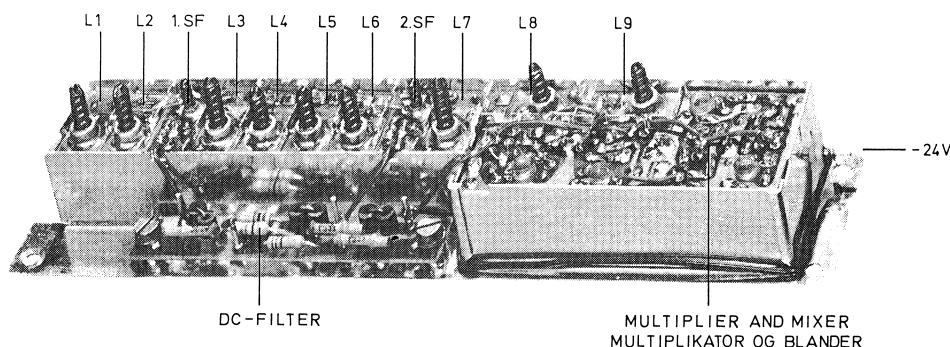
Crystal oscillator panel (one in the transmitter section and one in the receiver section) XS601

Power Supply Section

The power supply section consists of the PS601 power supply unit the main purpose of which is to convert 6-, 12- or 24-volt DC from a car battery or some similar power source into 24-volt stabilized DC for the transmitter/receiver section.

The following pages of this chapter contain a complete description of the circuits of the individual subunits and their specifications.

Receiver Converter RC661



The receiver converter consists of the following stages:

- 1st Signal Frequency Amplifier
- 2nd Signal Frequency Amplifier
- Mixer
- Oscillator-signal Buffer Amplifier
- 1st Oscillator-signal Tripler
- 2nd Oscillator-signal Tripler
- DC Filter

The stages and circuits of the receiver converter are built on a number of wiring boards which are housed in a screen box with partitions, providing screening of the entire unit and of each circuit separately. Only the DC-filter, which is built as a separate unit, is located outside the screen box.

The receiver converter serves the purpose of amplifying the incoming signal and converting it to a first intermediate frequency of 10.7 MHz, for which purpose an oscillator signal, amplified and multiplied, is injected into the mixer.

Silicon n-p-n transistors are used throughout, and all RF circuits are capacitance tuned and temperature stabilized.

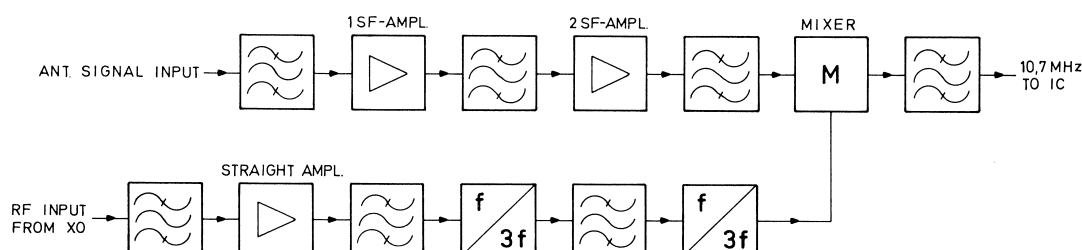
Mode of Operation

Signal Frequency Amplifiers

The incoming signal is applied, via a bandpass filter (L1 and L2), to the 1st signal-frequency amplifier. This stage operates in a grounded-emitter circuit and has a variable neutralizing capacitance (C8). From this stage, the amplified signal is fed through a four-circuit filter (L3, L4, L5, and L6) to the 2nd signal-frequency amplifier, which is identical with the preceding stage and has a variable neutralizing capacitance (C20). The 2nd signal-frequency amplifier works into a three-circuit filter (L7, L8, L9), the last circuit of which is common to the output signals of the signal-frequency amplifier and multiplier chain, the frequency difference being 10.7 MHz. For this reason the circuit has been made so wide that neither signal undergoes appreciable attenuation.

Mixer

From L9, the amplified and filtered signal from the antenna and the multiplied oscillator signal are fed to the emitter of the mixer transistor, which operates in a grounded base circuit.



The intermediate-frequency signal at 10.7 MHz is taken off across the collector circuit of the mixer, which can be matched to the following IF converter unit by means of a system of straps.

Buffer Amplifier and Multiplier Stages

The oscillator-signal buffer amplifier and the two following tripler stages are built on a wiring board which is screened from the other stages of the converter unit. The oscillator signal is applied to the buffer amplifier, which has low-impedance input and incorporates feedback and neutralizing circuits. The output of the buffer is fed via the circuit L12, which is tuned to the oscillator frequency, to the base of the 1st tripler. This stage operates in a grounded-emitter circuit.

From the collector circuit (L13) of the 1st tripler, signals are fed to the emitter of the 2nd tripler. This stage operates in a grounded-base circuit. The multiplied oscillator signal is thereafter applied to the mixer-stage emitter via the circuit L9.

Technical Specifications

Frequency Range

420 - 470 MHz.

Gain

Voltage gain from antenna to emitter of mixer:
11.5 dB.

Input Impedance

Nominal 50 dB.

Crystal Frequency Calculation

$$f_x = \frac{f_{ant} - 10.7}{9} \text{ MHz,}$$

where f_x is the crystal frequency in MHz and
 f_{ant} is the signal (antenna) frequency in MHz.

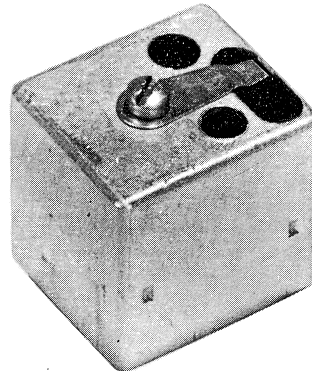
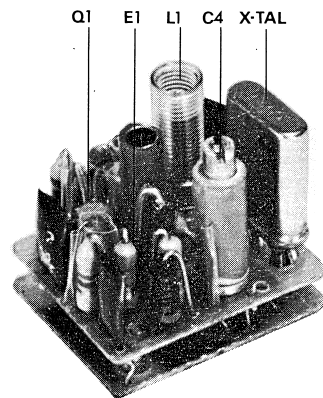
Crystal Frequency Ranges

See under technical specifications for the crystal oscillator type employed: XO611, XO662, or XO664.

Mechanical Dimensions

160 x 32 mm.

Receiver Oscillator Unit X0611



The receiver oscillator unit is a crystal-controlled oscillator. It is built on a double wiring board, and is a totally enclosed plug-in unit. The oscillator unit plugs into a crystal oscillator panel which has pins mating with sockets on the oscillator unit.

Mode of Operation

The oscillator is a third overtone series resonant Colpitts oscillator with the crystal connected at low-impedance points to ensure good frequency stability.

Undesired pulling of the oscillator frequency is minimized through damping of the collector circuit.

The oscillator is started up by connecting the CHANNEL SHIFT terminal to chassis through the channel selector in the control box. A diode in series with the -24V supply lead prevents any flow of undesired current in the unit.

The oscillator signal is fed to the receiver converter via the crystal oscillator panel.

The operating frequency can be adjusted by means of a trimmer capacitor located close to the crystal.

Technical Specifications

Crystal Frequency Range

48.4 - 56.9 Mc/s.

Frequency Pulling

$\frac{\Delta f}{f} : \pm 30 \times 10^{-6}$.

Frequency Stability

For voltage variations within 24V $\pm 2.5\%$:

Better than $\pm 0.2 \times 10^{-6}$.

In temperature range -30°C to $+80^{\circ}\text{C}$:

Better than $\pm 2 \times 10^{-6}$.

Load Impedance

50 ohms.

Power Output

Approx. 1 mW.

Receiver Oscillator Unit XO662

The receiver oscillator unit is a crystal-controlled oscillator. It is built on a double wiring board, and is a totally enclosed plug-in unit. The oscillator unit plugs into a crystal oscillator panel which has pins mating with sockets on the oscillator unit.

Mode of Operation

The oscillator uses a parallel-resonant Colpitts circuit. It is followed by a multiplier stage which quadruples the crystal frequency. The oscillator is started up by connecting the CHANNEL SHIFT terminal to chassis through the channel selector. A diode in series with the -24V supply prevents any flow of undesired current in the unit.

A capacitance diode E, biased by a temperature-dependent voltage, compensates for frequency variations at high and low temperatures. The degree of compensation is adjusted with potentiometer R10. Frequency adjustment is performed with trimmer capacitors C10 and C11. The RF output of the oscillator is fed via the crystal oscillator panel to the receiver converter.

Technical Specifications

Coverage

For crystal: 11.37 - 14.23 MHz.

For output voltage: 45.5 - 56.9 MHz.

Frequency Pulling

$$\frac{\Delta f}{f_o} \geq \pm 30 \times 10^{-6}$$

Frequency Stability

Against voltage variations of $-24V \pm 2.5\%$:

Better than $\pm 1.5 \times 10^{-6}$.

In temperature range -25°C to $+80^{\circ}\text{C}$: Better than $\pm 5 \times 10^{-6}$.

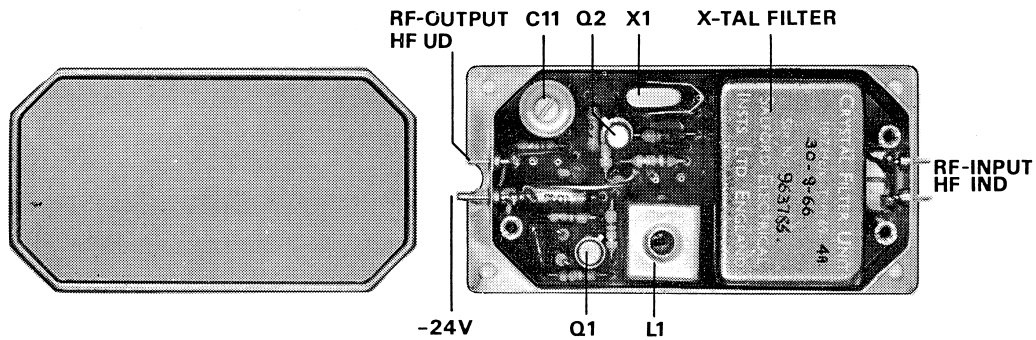
Load Impedance

50 ohms.

Output Voltage

170 mV/50 ohms.

IF Converters IC601, IC602, IC603



The IF converter unit is built on a wiring board, and is housed in a metal box with screw-on lid. The unit consists of the following stages:

Crystal Filter
Oscillator
Mixer

The IF converter filters the high intermediate frequency signal at 10.7 Mc/s and converts it to a low intermediate frequency signal at 455 kc/s.

IF converter IC601 is used in equipments with 50 kc/s channel separation.

IF converter IC602 is used in equipments with 25 kc/s channel separation.

IF converter IC603 is used in equipments with 20 kc/s channel separation.

The three converters use different crystal filters but are otherwise quite identical.

Mode of Operation

Crystal Filter

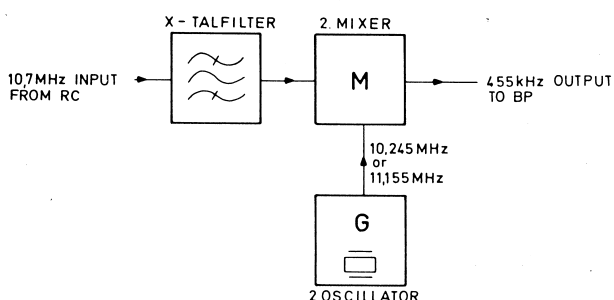
From the receiver converter unit, RC, the high intermediate frequency signal at 10.7 Mc/s is fed to the crystal filter. The filter connects to the mixer via a parallel resonant circuit, which ensures a perfect impedance match.

Oscillator

The oscillator is a crystal-controlled Colpitts oscillator. The crystal frequency is normally 10.245 Mc/s, but in cases where one of the harmonics of the local oscillator coincides with the frequency of the incoming signal, which might cause interference, a crystal frequency of 11.155 Mc/s is chosen instead. The crystal oscillates in a parallel resonant circuit, and frequency adjustment is performed with a trimmer capacitor.

Mixer

Both the 10.7 Mc/s signal and the oscillator signal are applied to the base of the mixer transistor. The low intermediate frequency signal at 455 kc/s is taken off at the collector.



Technical Specifications

Input Frequency

10.7 Mc/s.

Output Frequency

455 kc/s.

Input Impedance

910 ohms // 20 pF.

Output Impedance

3.9 k ohms // 480 pF.

Maximum Frequency Swing

IC601: ± 15 kc/s

IC602: ± 5 kc/s

IC603: ± 4 kc/s

Bandwidth

IC601 At 3 dB attenuation relative to 10.7 Mc/s: Greater than ± 15 kc/s.
At 50 dB attenuation relative to 10.7 Mc/s: Less than ± 50 kc/s.

IC602 At 3 dB attenuation relative to 10.7 Mc/s: Greater than ± 7.5 kc/s.
At 50 dB attenuation relative to 10.7 Mc/s: Less than ± 25 kc/s.

IC603 At 3 dB attenuation relative to 10.7 Mc/s: Greater than ± 6 kc/s.
At 50 dB attenuation relative to 10.7 Mc/s: Less than ± 20 kc/s.

Bandpass Ripple

IC601 Less than 2 dB

IC602 Less than 1.5 dB

IC603 Less than 1.5 dB

Oscillator Frequency

Calculation of crystal frequency (fx):

$$fx = 10.7 \text{ Mc/s} - 0.455 \text{ Mc/s} = 10.245 \text{ Mc/s}.$$

However, at certain incoming frequencies the low crystal frequency must not be used owing to the risk of harmonic radiation. In this cases the high crystal frequency is used.

The calculation of the high crystal frequency is as follows:

$$fx = 10.7 \text{ Mc/s} + 0.455 \text{ Mc/s} = 11.155 \text{ Mc/s}.$$

The lists below specifies what type of crystal which is to be used within the various frequency ranges.

A = 10.245 Mc/s

B = 11.155 Mc/s

146-174 Mc/s

Receiver frequency range	fx.
146.0 - 152.5 Mc/s	A
152.5 - 154.9 Mc/s	B
154.9 - 162.7 Mc/s	A
162.7 - 165.1 Mc/s	B
165.1 - 174.0 Mc/s	A

68-88 Mc/s

Receiver frequency range	fx.
68.0 - 70.5 Mc/s	A
70.5 - 72.9 Mc/s	B
72.9 - 80.8 Mc/s	A
80.8 - 83.2 Mc/s	B
83.2 - 88.0 Mc/s	A

420-470 Mc/s

Receiver frequency range	fx.
420.0 - 421.5 Mc/s	B
421.5 - 428.8 Mc/s	A
428.8 - 431.7 Mc/s	B
431.7 - 439.1 Mc/s	A
439.1 - 442.0 Mc/s	B
442.0 - 449.3 Mc/s	A
449.3 - 452.2 Mc/s	B
452.2 - 459.6 Mc/s	A
459.6 - 462.5 Mc/s	B
462.5 - 470.0 Mc/s	A

Crystal Specification

In the temperature range -15°C to $+60^{\circ}\text{C}$:
S-98-8.

In the temperature range -25°C to $+65^{\circ}\text{C}$:
S-98-12.

Frequency Pulling Range for Osc.

Greater than $\pm 50 \times 10^{-6}$.

Available Power Gain

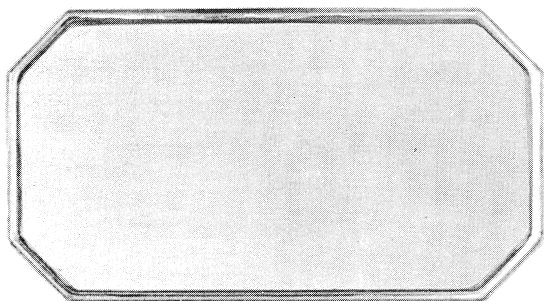
With 10.245 Mc/s crystal: Greater than 15dB.

With 11.155 Mc/s crystal: Greater than 14dB.

Dimensions

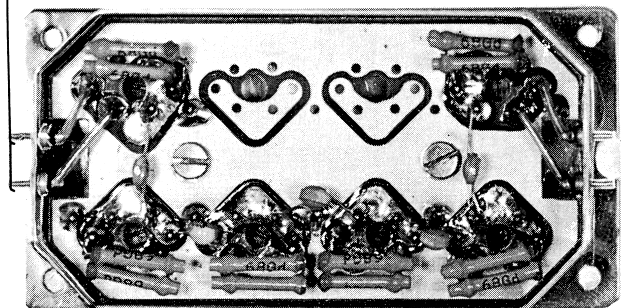
80 x 40 x 29 mm.

IF Filters BP601 and BP602



RF-OUTPUT
HF UD

RF-INPUT
HF IND



The IF filter is built on a wiring board, and is housed in a hermetically sealed metal box.

The filter is a selective bandpass filter consisting of six resonant circuits capacitively coupled to each other at their high-impedance ends. Its input and output are inductively coupled to the first and last resonant circuits, respectively, and are consequently galvanically separated. The filter is artificially aged after wiring and insertion in the box.

IF filter BP601 is used in equipments with 50 kc/s channel separation.

IF filter BP602 is used in equipments with 20 or 25 kc/s channel separation.

Technical Specifications

Centre Frequency

455 kc/s.

Generator Impedance

3.9 k ohms // 480 pF.

Load Impedance

1 k ohm // 480 pF.

Bandwidth

BP601: At 3dB attenuation relative to 455 kc/s: Greater than ± 15 kc/s.
At 45 dB attenuation relative to 455 kc/s: Greater than ± 35 kc/s.

BP602: At 3dB attenuation relative to 455 kc/s: Greater than ± 8 kc/s.
At 45dB attenuation relative to 455 kc/s: Less than ± 20 kc/s.

Insertion Loss

BP601: 2 dB

BP602: 3 dB.

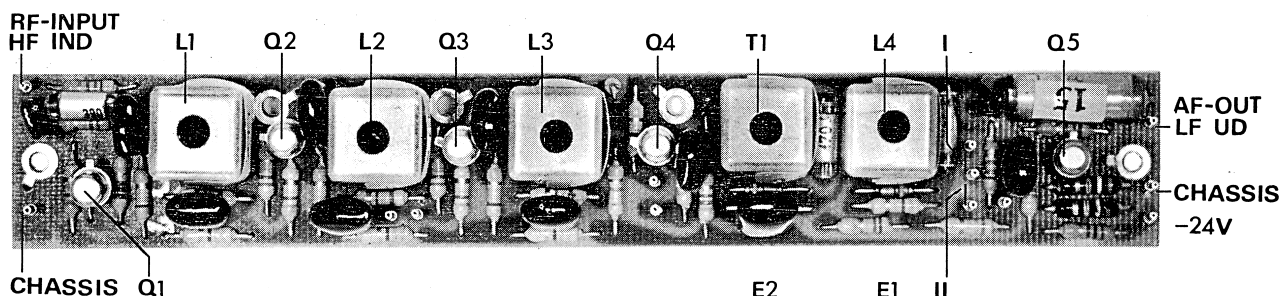
Centre Frequency Variation

At 3 dB attenuation relative to 455 kc/s:
Less than ± 700 c/s.

Dimensions

80 x 40 x 29 mm.

IF Amplifier IA601



The IF amplifier is built on a wiring board. It consists of the following stages:

Four IF Amplifier Stages
Discriminator
Output Amplifier

The IF amplifier serves the purpose of amplifying and rectifying the low intermediate-frequency signal at 455 kc/s. It also amplifies the audio output delivered by the discriminator.

Mode of Operation

IF Amplifier Stages

From the filter (BP), the low intermediate-frequency signal at 455 kc/s is applied to the IF amplifier unit.

Interstage coupling consists of a single tuned collector circuit capacitively tapped for the base of the transistor of the following stage. The last IF amplifier stage works into the discriminator. The last two amplifier stages operate as voltage limiters.

Discriminator and Output Amplifier

The discriminator is an inductively coupled Foster Seeley discriminator the output circuit

of which comprises a voltage divider consisting of resistors R29, R30, and R31. By shifting a strap back and forth between two taps on the voltage divider, the audio output voltage may be altered so that the IF amplifier unit can be used for different channel separations.

The strap marked I in the photograph is used in equipments with 20 or 25 kc/s channel separation.

The strap marked II in the photograph is used in equipments with 50 kc/s channel separation (see also circuit diagram of the IA601 IF amplifier at the back of this manual).

In order to ensure that the discriminator will be loaded lightly, the following audio amplifier stage is an emitter follower using a high-resistance base biasing network.

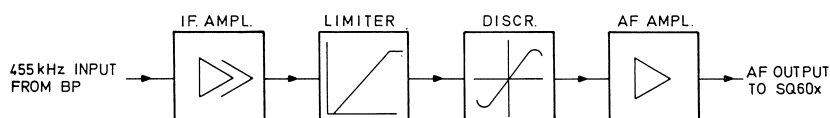
Technical Specifications

Intermediate Frequency

455 kc/s.

Max. Frequency Swing

± 15 kc/s or ± 5 kc/s/ ± 4 kc/s, depending on strap used.



IF Bandwidth

± 20 kc/s at 3 dB attenuation.

Generator Impedance

1 k ohm / 0.25 mH.

Input Impedance

1 k ohm // 480 pF.

Output Impedance

340 ohms.

Discriminator Bandwidth

Linear to ± 20 kc/s.

Discriminator Slope

Measured with instrument with $R_i = 1000$ ohms;

$2.2 \mu\text{A/kc/s}$.

Discriminator Centre Frequency Stability

± 1 kc/s.

Gain

The gain is determined as the input voltage at which the audio output voltage has dropped 1 dB below max. audio output voltage. $\Delta f = \pm 10.5$ kc/s and $f_{\text{mod}} = 1000$ c/s: $1.6 \mu\text{V}$.

Audio Output Level

At $f_{\text{mod}} = 1000$ c/s.

For $\Delta F = \pm 2.8$ kc/s, strapped for $\Delta F_{\text{max.}} = \pm 5$ kc/s: 0.9 V.

For $\Delta F = \pm 3.5$ kc/s, strapped for $\Delta F_{\text{max.}} = \pm 5$ kc/s: 1.1 V.

For $\Delta F = \pm 10.5$ kc/s, strapped for $\Delta F_{\text{max.}} = \pm 15$ kc/s: 1.1 V.

Demodulation Characteristic

Flat: $+0/-1$ dB.

Deviation relative to 1000 c/s in the range 300 - 3000 c/s. $\Delta F_{\text{max.}} = 0.2 \times \Delta F_{\text{max.}}$ at 1000 c/s.

Distortion

In the range 3000 - 3000 c/s:

For $\Delta F = \pm 15$ kc/s, strapped for $\Delta F_{\text{max.}} = \pm 15$ kc/s: 1.4 %.

For $\Delta F = \pm 5$ kc/s, strapped for $\Delta F_{\text{max.}} = \pm 5$ kc/s: 1.2 %.

Min. Load Impedance

In the range 300 - 3000 c/s: approx. 2 k ohms.

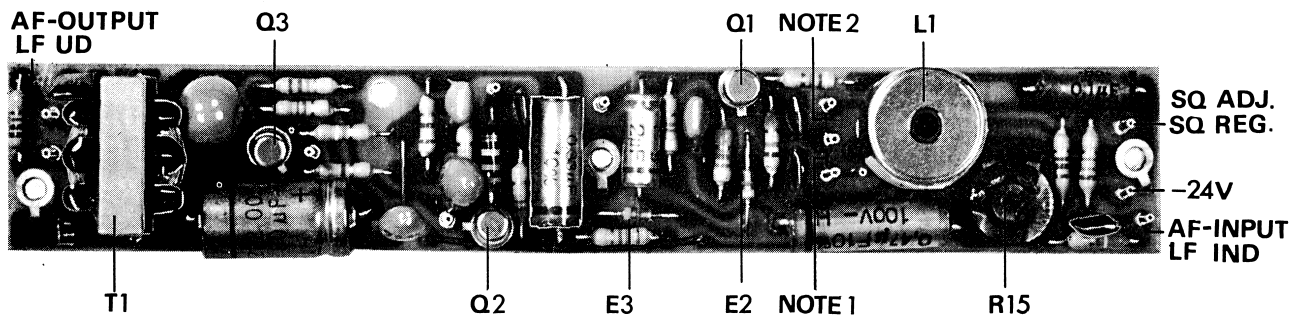
Current Drain

10 mA.

Dimensions

160 x 24 mm.

Squelch and Audio Amplifier SQ601



The squelch and audio amplifier unit is built on a wiring board. It consists of the following stages:

Noise Amplifier
Noise Rectifier
Audio Amplifier

The audio amplifier stage serves the purpose of amplifying the demodulated signal delivered by the discriminator whilst the squelch circuit - in the absence of an incoming signal - amplifies and rectifies the discriminator noise, permitting use of the rectified noise voltage for muting the audio amplifier stage.

Mode of Operation

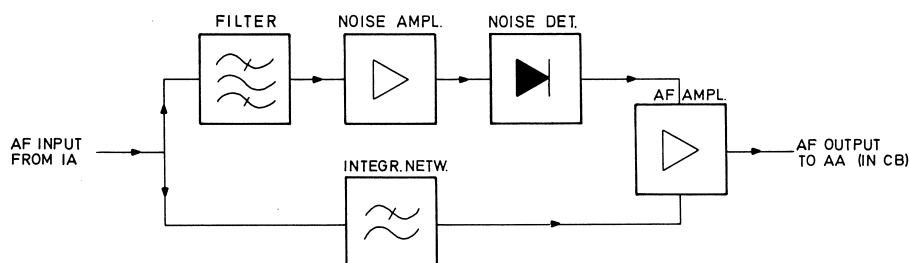
Audio Amplifier

The audio signal from the discriminator in the preceding intermediate frequency amplifier unit, IA, is applied to the audio amplifier stage via an integrating network and a potentiometer.

The integrating network, which in the case of phase modulation consists of resistor R16 and capacitor C12, produces a -6dB/octave frequency characteristic. For frequency modulation, C12 is replaced by a resistor, R18, resulting in a flat frequency characteristic. The following potentiometer, R15, makes it possible to adjust the gain for nominal power output (3dBm). The audio amplifier has transformer output with an output impedance of 600 ohms.

Squelch Circuit

A portion of the noise from the discriminator is filtered in the bandpass filter (L1, C2) and fed to the noise amplifier stage. The transistor of this stage is biased in such a manner that only noise peaks of a certain magnitude can make the transistor conductive. The noise voltage consequently generated in the collector circuit is rectified by a diode and applied to transistor Q2, which operates as a DC amplifier.



When a sufficiently high noise voltage is applied to the noise rectifier, the collector-emitter impedance of the DC amplifier will be so low that the base bias for the audio amplifier disappears, thereby muting the latter.

The bias for the noise amplifier, and consequently the squelch sensitivity, can be adjusted with a squelch potentiometer located in the control box.

The resonant frequency of the bandpass filter in the input circuit of the squelch unit can be altered by strapping, permitting use of the filter at channel separations of 20, 25, and 50 kc/s.

NOTE 1 in the photograph of the unit shows the strap for 20 and 25 kc/s.

NOTE 2 in the photograph of the unit shows the strap for 50 kc/s.

Technical Specifications

Input Impedance

In the range 300 - 3000 c/s:
Greater than 3 k ohms.

Output Impedance

At 1000 c/s: 600 ohms.

Nominal Load Impedance

600 ohms.

Audio Output Level

At 1000 c/s and input voltage of 0.6V and R15 in the fully clockwise position: 1.3V.

Frequency Characteristic (PM)

In the range 300 - 3000 c/s relative to 1000 c/s:
-6dB/octave +0/-1dB.

Frequency Characteristic (FM)

In the range 300 - 3000 c/s relative to 1000 c/s:
Flat ± 0 dB.

Distortion

At 3dBm power output and 1000 c/s: 2%.

Output Noise Attenuation

Unsquelled: better than 50 dB
Squelled: better than 70 dB.

Squelch Sensitivity

For $\Delta F = 0.7 \times \Delta F_{max}$, and $f_{mod} = 1000$ c/s, full unsquelling occurs at:

Min. signal-to-noise ratio in speech channel:
3 dB.

Max. signal-to-noise ratio in speech channel:
23 dB.

Squelch Hang

At max. squelch sensitivity: approx. 0.5 sec.
At min. squelch sensitivity: approx. 0.1 sec.

Channel Separation

50 kc/s or 25/20 kc/s depending on strap.

Delay

Approx. 50 msec.

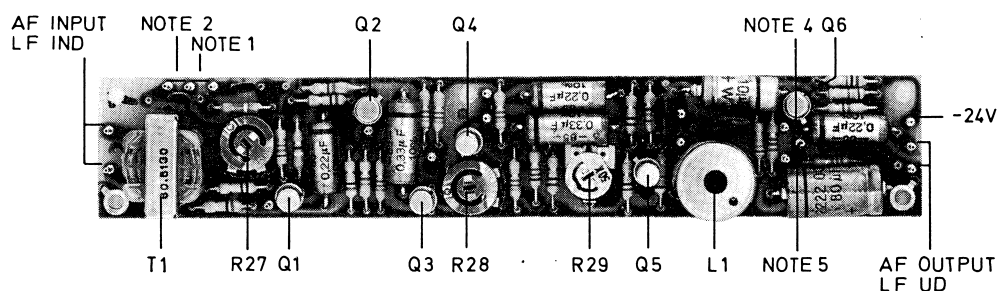
Current Drain

For unsquelled operation (audio output): 12 mA.
For squelled operation (no audio output): 8.5 mA.

Dimensions

148 x 24 mm.

Audio Amplifiers AA 601 and AA 608



Audio amplifiers AA601 and AA608 are built on wiring boards. They consist of the following stages:

Differentiating network
1st amplifier
Limiter
Integrating network
2nd amplifier
Splatter filter
Output amplifier.

The audio amplifier performs two important functions; it amplifies the signal from the microphone to a level suitable for the modulator, and it limits the amplitude of the said signal so that the maximum permissible frequency swing will not be exceeded.

Besides, the AA601 attenuates frequencies above 3000 Hz and the AA608 frequencies above 2500 Hz, thus preventing adjacent-channel interference.

Mode of Operation

Differentiating Network

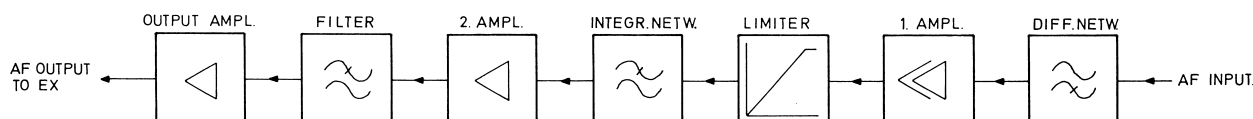
Each audio amplifier has 600-ohm balanced transformer input followed by a potentiometer, R27, for sensitivity adjustment. The following differentiating network (pre-emphasis network)

is switchable between two different time constants: the strap designated NOTE 1 cuts in the differentiating network R2, C3, which provides straight phase modulation, whilst the strap designated NOTE 2 cuts in the network composed of (R1 + R2) and C1, which provides mixed phase and frequency modulation, a phase modulation characteristic being obtained for modulating frequencies below 1000 Hz and frequency modulation for modulating frequencies above 1000 Hz. From the differentiating network, the signal is fed to the 1st amplifier stage.

1st Amplifier and Limiter

The 1st amplifier consists of two transistor stages in a conventional emitter circuit. The use of un-bypassed emitter resistors results in a high degree of negative feedback. The following limiter consists of two transistors with a common emitter resistor. Limiting is accomplished in the following manner:

When the input voltage of transistor Q3 becomes positive with respect to the emitter voltage, Q3 will attempt to draw more current, and the emitter/base voltage of transistor Q4 will consequently decrease, causing the latter transistor to draw less current. A further increase in input voltage will cause Q3 to draw so much cur-



rent that Q4 will cut off, thus limiting the signal amplitude. If the input signal of Q3 becomes negative with respect to the emitter voltage, the full current will flow through Q4. In this case, Q3 will cut off, again causing limiting. The symmetry of the limiting is adjustable with potentiometer R28.

Integrating Network

The integrating network consists of the output impedance of transistor Q4 in conjunction with capacitor C6. This capacitor is connected via a strap; by removing the strap, the capacitor can be left out while making measurements on the limiter, thereby avoiding integration.

The following potentiometer, R29, controls the output voltage of the audio amplifier and hence also the maximum frequency swing of the transmitter with the limiter operative.

2nd Amplifier and Splatter Filter

The 2nd amplifier consists of a single transistor stage with an un-bypassed emitter resistor, resulting in a high degree of negative feedback. The amplifier stage is followed by a splatter filter. This is a pi-network whose cutoff frequency is 3000 Hz in the AA601 and 2500 Hz in the AA608. It serves the purpose of attenuating higher frequencies such as harmonics generated by the clipper and amplifier stage.

Output Amplifier

The output amplifier consists of a single transistor stage with an un-bypassed emitter resistor. The collector resistor is a voltage divider (R25 and R17), making it possible to alter the output voltage - and hence the frequency swing - by a restraping operation.

Depending on the frequency band in use and the desired frequency swing (channel separation), the units should be strapped in accordance with the notes on the associated diagrams.

Technical Specifications

Current Drain

13 mA.

Clipping Level (1000 Hz)

Peak value of clipped voltage at test point 24 with strap designated NOTE 3 removed: 2.9 V peak.

Minimum Input Voltage for Clipping (1000 Hz)

The input voltage at which clipping occurs with potentiometer R27 turned full on (and with strap designated NOTE 3 removed): 34 mV.

Maximum Output Voltage (1000 Hz)

Maximum output voltage across 10 k ohm load resistor, at full clipping and with potentiometer R29 turned full on (with straps designated NOTE 3 and NOTE 4 inserted): In AA601: 3.5V peak. In AA608: 1.9 V peak.

Harmonic Distortion (1000 Hz)

Distortion is measured at output voltage of 0.8V, corresponding to 0.7 ΔF max. Potentiometer R29 is adjusted so that the output voltage across 10 k ohms is 1.5 V peak for an input voltage of 20 dB above clipping level. The input voltage is reduced to 110 mV, and potentiometer R27 is adjusted for an output voltage of 0.8 V across 10 k ohms: 0.5%.

Frequency Response:

The unit is adjusted as for measurement of harmonic distortion. The input voltage is reduced by 20 dB to 11 mV.

Frequency response, AA601:

flat between 300 and 3000 Hz $\pm 0.2/0.8$ dB; at 5 kHz the voltage has dropped 12 dB below 0 dB at 1000 Hz.

Frequency response, AA608:

flat between 300 and 2500 Hz $\pm 0.2/0.8$ dB; at 5 kHz the voltage has dropped 12 dB below 0 dB at 1000 Hz.

Input Impedance

600 ohms. Input impedance is floating.

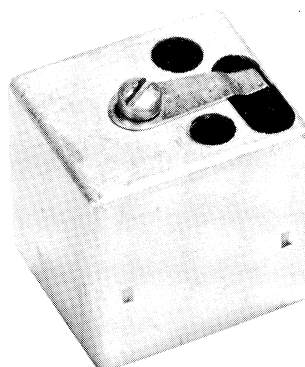
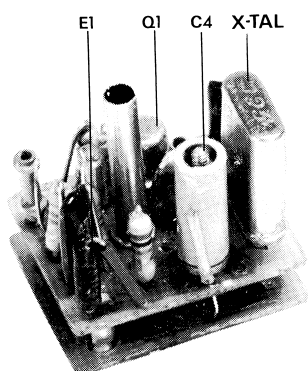
Output Impedance

3.9 k ohms or 1.2 k ohms, depending on strap-ping.

Dimensions

160 x 28 mm.

Transmitter Oscillator Unit X0631



The transmitter oscillator unit is a crystal-controlled oscillator and is built on a double wiring board. It is a totally enclosed plug-in unit.

The oscillator units plugs into a crystal oscillator panel which has pins mating with sockets on the oscillator unit.

Mode of Operation

The oscillator uses a parallel-resonant Colpitts circuit with the crystal loosely coupled to the transistor. The oscillator is started up by connecting the CHANNEL SHIFT terminal to chassis through the channel selector in the control box. A diode in series with the -24 V supply lead prevents any flow of undesired current in the unit. The oscillator signal is fed via the crystal oscillator panel to the RF input of the exciter. The operating frequency can be adjusted by means of a trimmer capacitor located close to the crystal.

Technical Specifications

Crystal Frequency Range

11.3 - 14.66 Mc/s.

Frequency Pulling

$$\frac{\Delta f}{f} : \pm 30 \times 10^{-6}.$$

Frequency Stability

For voltage variations within 24V $\pm 2.5\%$:
Better than $\pm 1 \times 10^{-6}$.

Load Impedance

25 ohms.

Power Output

Approx. 80 μ W.

Transmitter Oscillator Unit X0661

The transmitter oscillator unit is a crystal-controlled oscillator and is built on a double wiring board. It is a totally enclosed plug-in unit.

The oscillator plugs into a crystal oscillator panel which has pins mating with sockets on the oscillator unit.

Mode of Operation

The oscillator uses a parallel-resonant Colpitts circuit with the crystal loosely coupled to the transistor. The oscillator is started up by connecting the CHANNEL SHIFT terminal to chassis through the channel selector. A diode in series with the -24 V supply lead prevents any flow of undesired current in the unit. The oscillator signal is fed via the crystal oscillator panel to the RF input of the exciter.

The operating frequency can be adjusted by means of a trimmer capacitor located close to the crystal.

Technical Specifications

Crystal Frequency Range

11.3 - 14.66 MHz.

Frequency Pulling

$$\frac{\Delta f}{f} \geq \pm 30 \times 10^{-6}.$$

Frequency Stability

For voltage variations within $24V \pm 5\%$:

Better than $\pm 0.1 \times 10^{-6}$.

In temperature range -30°C to $+80^{\circ}\text{C}$:

Better than $\pm 5 \times 10^{-6}$.

Load Impedance

25 ohms.

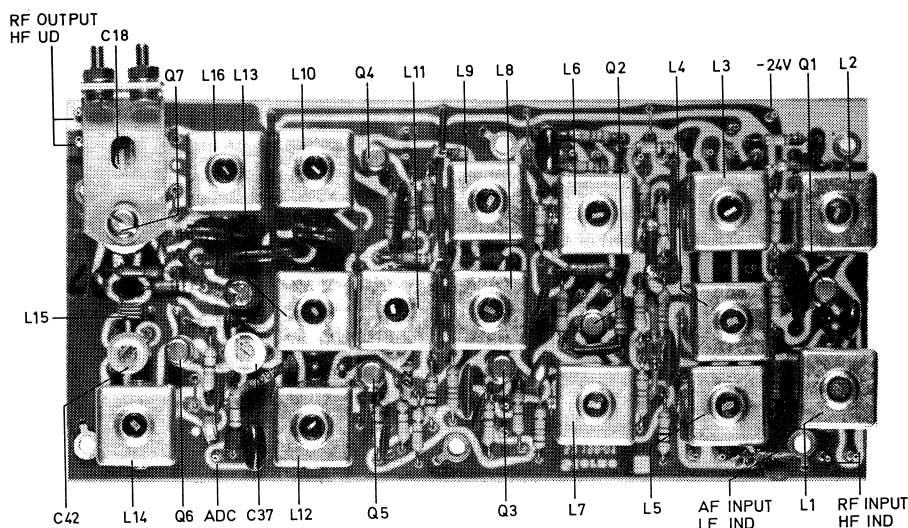
Power Output

Approx. 25 microwatts.

Crystal

Type 98-16.

Exciter EX661



The exciter is built on a wiring board. It consists of the following stages:

- 1st Buffer
- Modulator
- 2nd Buffer
- 1st Frequency Doubler
- Frequency Tripler
- 2nd Frequency Doubler
- 1st Power Amplifier
- 2nd Power Amplifier

The exciter performs two main functions: it modulates the RF oscillator signal and converts it to a frequency and a level suitable for the following power amplifier unit, PA.

Mode of Operation

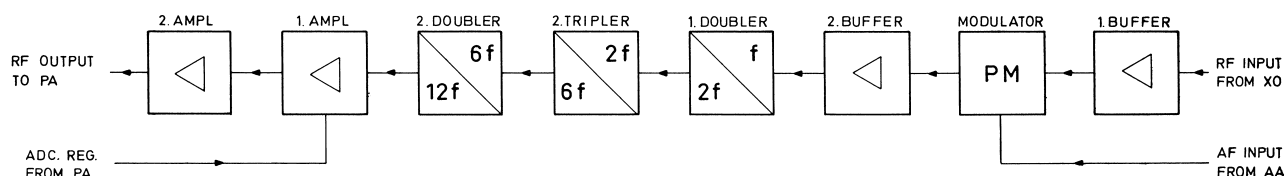
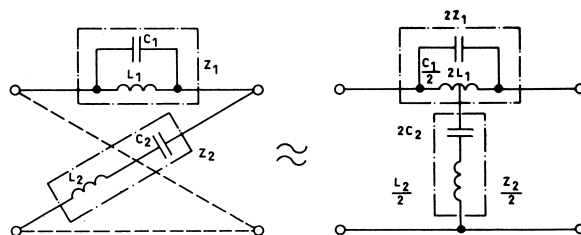
1st Buffer

The RF signal from the oscillator is applied to the 1st buffer (transistor Q1), which has tuned LC circuits in its base and collector leads. The stage is not neutralized; stability is accomplished

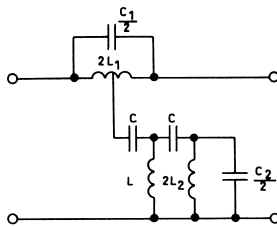
by damping the collector circuit, L2, with a resistor. This stage amplifies the input signal to a level suitable for the modulator. The base circuit serves as an impedance transformer, providing an input impedance of approx. 50 ohms.

Phase Modulator

The phase modulator is a modified bridged T network composed of reactances. This circuit has low insertion loss, constant four-terminal impedances, and produces a relatively large linear phase swing. The bridged T network is derived from a lattice section as shown below.



In these networks, the insertion loss is zero (no-loss reactances) and the four-terminal impedance is constant if the value of $Z_1 \times Z_2$ is constant. The phase shift introduced by the network can be varied by varying the impedances; however, this must be done in such a way that $Z_1 \times Z_2$ remains constant. In order to make the circuit practically applicable as a phase modulator, the series resonant circuit is replaced by a quarter wave transformer and a parallel circuit.



The advantage of this arrangement is that the phase shift can be varied by varying the two circuit capacitances in the same manner. This also meets the requirement that $Z_1 \times Z_2$ must be constant. The circuit capacitances are capacitance diodes on whose bias the modulating voltage is superimposed.

Attenuating networks inserted on either side of the modulator reduce interaction between the modulator and the buffer stage during alignment.

2nd Buffer

This stage is largely identical with the 1st buffer. It, too, has tuned LC circuits in its base and collector leads. Both circuits are damped by parallel resistors to keep the stage stable. Similarly, the damping of the circuits of the first and second buffer stages cause the operation of the modulator to become less dependent on the tuning of the buffer stages.

Frequency Multipliers

The frequency multiplier chain comprises a doubler, a tripler, and another doubler, with a total frequency multiplication factor of twelve. These stages are not neutralized, the tuned circuit being damped by resistors in the interests of good stability. The circuits between the multipliers and between the last doubler and the 1st

power amplifier are double-tuned bandpass filters with close-to-critical coupling between circuits. These bandpass filters set a limit to the bandwidth of the exciter by attenuating undesired harmonics generated in the frequency multiplication process.

Power Amplifiers

The 1st and 2nd power amplifiers raise the signal level to approx. 500 mW in a 50-ohm load. Impedance matching between stages is accomplished by means of a tapped parallel resonant circuit (L14). The tap connects - via a series resonant circuit consisting of C42 and L15 - to the base of transistor Q7 of the 2nd power amplifier. Battery voltage for the 1st power amplifier is taken from the drive control circuit of the following RF amplifier unit, PA. The power output delivered by the exciter is adjusted by varying this voltage. The emitter resistor of the 2nd power amplifier is un-bypassed in the interests of better stability; another advantage of omitting bypassing is that transistor tolerances are then without importance.

A pi-network provides impedance matching to the 50-ohm load imposed by the following RF power amplifier unit.

Technical Specifications

Frequency Range

140 - 156.6 Mc/s.

Frequency Multiplication Factor

12.

Crystal Frequency Bands

11.66 - 13.06 Mc/s.

Power Output

700 mW.

Power Input

40 μ W.

Generator Impedance

50 ohms.

Load Impedance

50 ohms.

Audio Input Impedance

At 1000 c/s: 10 k ohms.

Modulation

Phase modulation, +6 dB/octave ± 1 dB within 300
- 3000 c/s.

Modulation Sensitivity

Modulating voltage (for $\Delta f = 0.7 \times \Delta F_{\text{max}}$ at
1000 c/s):

At 50 kc/s channel separation: 0.8V

At 25 kc/s channel separation: 0.26V

At 20 kc/s channel separation: 0.22V.

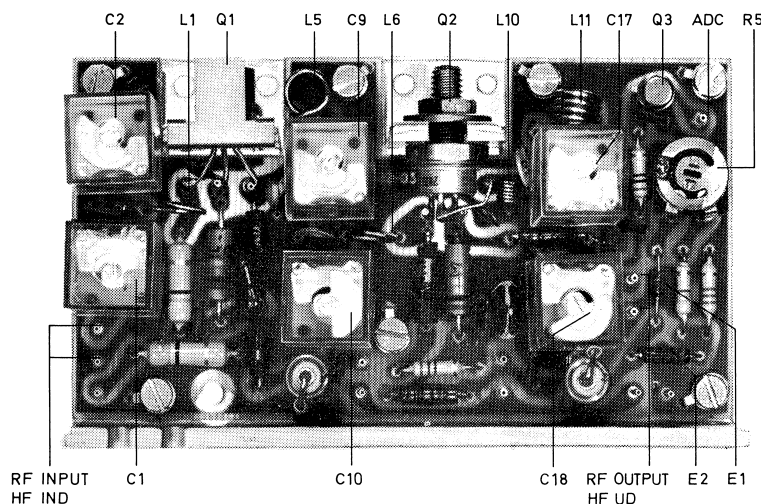
Modulation Distortion

Measured without de-emphasis: 5%.

Dimensions

68 x 140 x 25 mm.

RF Power Amplifier PA661



The power amplifier is built on a wiring board. It consists of the following stages:

1st Power Amplifier (Driver)

2nd Power Amplifier (Output)

ADC Circuit (Automatic Drive Control Circuit).

The RF power amplifier is a Class C amplifier. It raises the RF signal level to approx. 10 watts in a 50-ohm load. An ADC circuit ensures constant current through the output transistor and so prevents it from being overloaded. This circuit also causes the output of the RF power amplifier to be less dependent on variations in supply voltage and ambient temperature.

Mode of Operation

Driver Stage and Output Stage

The driver amplifies the signal from the EX exciter to a level (approx. 3 - 4 watts) suitable for driving the following output amplifier.

Pi-networks are used for matching the output stage to the driver and to the load impedance into which it works.

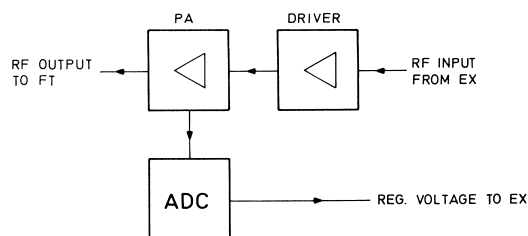
ADC Circuit (Automatic Drive Control Circuit)

This circuit consists of one transistor stage operating as a DC amplifier. The transistor base receives, via a potentiometer, a refer-

ence voltage which is produced by a zener diode. There is a DC path from the emitter of this transistor to the emitter of the output stage of the power amplifier unit, where a 1-ohm resistor provides operating voltage for the drive control circuit.

Lastly, the collector of the control transistor connects to the 1st power amplifier stage of the EX exciter.

An increase in the current through the output stage will result in a voltage drop across the emitter resistor and hence also in a decrease in the base-emitter voltage of the control transistor. Consequently, the supply voltage applied to the 1st power amplifier stage will decrease, and so will the drive applied to the output stage. This will reduce the current through the output stage.



Technical Specifications

Frequency Range

140-157 Mc/s.

Power Output

Approx. 11W. Adjustable by means of the ADC circuit.

Current Drain

700 mA at 11 watts power output.

Input Impedance

50 ohms.

Output Impedance

50 ohms.

Gain

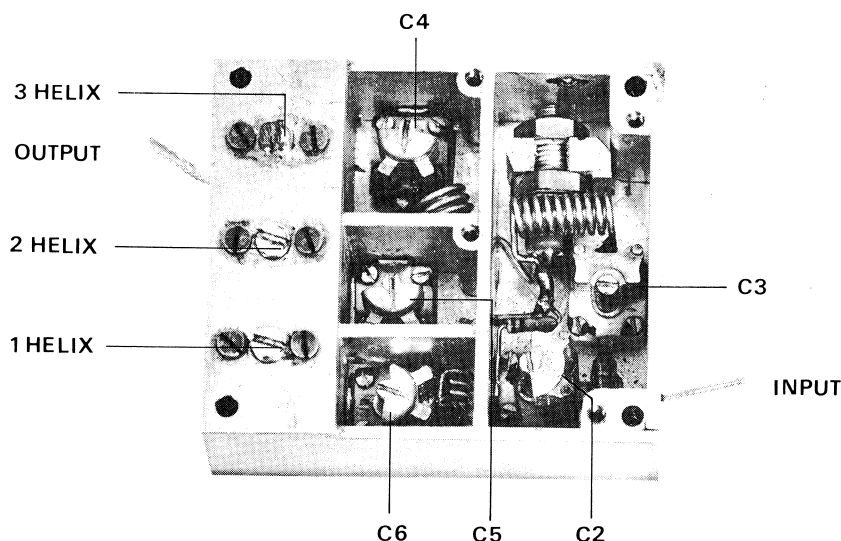
15 dB at 156 Mc/s.

The gain varies over the frequency range.

Dimensions

56 x 96 x 29 mm.

Frequency Tripler FT661



The frequency tripler is a totally enclosed unit consisting of a varactor tripler followed by a bandpass filter.

The unit is employed as a transmitter power output stage in the 420-470 MHz frequency band.

Mode of Operation

Varactor Tripler

The varactor tripler consists of a varactor diode and its associated network. The necessary bias for the diode is provided by a resistor R1 shunted across the diode.

The input circuit L1, C1, C2, and C3 functions as a matching network between the PA stage of the preceding unit and the varactor diode. This network is tuned to the 150 MHz band.

The circuit L2, C4 is an idler circuit which is tuned to resonance at the second harmonic of the input frequency.

The circuits L3, L5, and L4, L6 are tuned to the output frequency. They function as a filter and a matching network, respectively. Coupling between the circuits is a combination of inductive and capacitive coupling.

Helix Filter

A selective bandpass filter consisting of three helix circuits inserted between the varactor tripler and the antenna keeps down radiation of undesired frequencies.

Technical Specifications

Frequency Range

420-470 MHz.

Power Output

6 watts.

Input Impedance

50 ohms.

Output Impedance

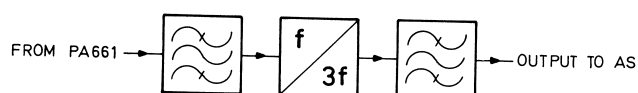
50 ohms.

Efficiency

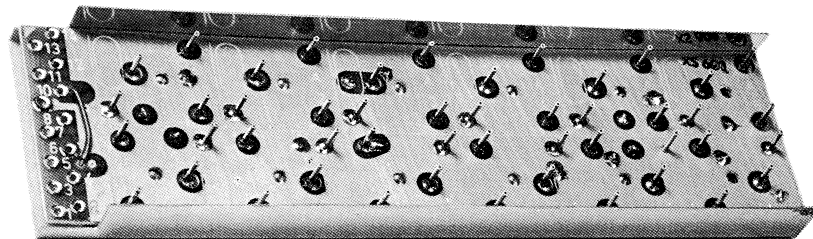
60 %.

Mechanical Dimensions

50 x 64 x 29 mm.



Crystal Oscillator Panel XS601



The crystal oscillator panel consists of a wiring board with conductors on both sides, and a screen. The station uses two panels of this type, one for the transmitter-oscillator units and one for the receiver-oscillator units.

The front of the wiring board has plug pins for connection of up to 12 oscillator units, a crystal oscillator unit being required for each frequency channel provided in the station.

In order to ensure that the channels are equipped with the correct oscillators - and hence the correct frequencies - the plug pins of the wiring board are marked with the channel numbers 1-12.

Mode of Operation

Channel Switching

Channel switching is performed with the channel selector in the control desk or control box of the station. The switch contacts connect the transmitter and receiver oscillator units of the selected channel to chassis, thereby applying power to them since all transmitter and receiver oscillators connect to the -24V potential during transmit and receive, respectively.

If the station is equipped with more than 8 channels, a group switching system is used which incorporates a group switching relay, located outside the crystal oscillator panel. This system serves the purpose of limiting the number of conductors in the control cable.

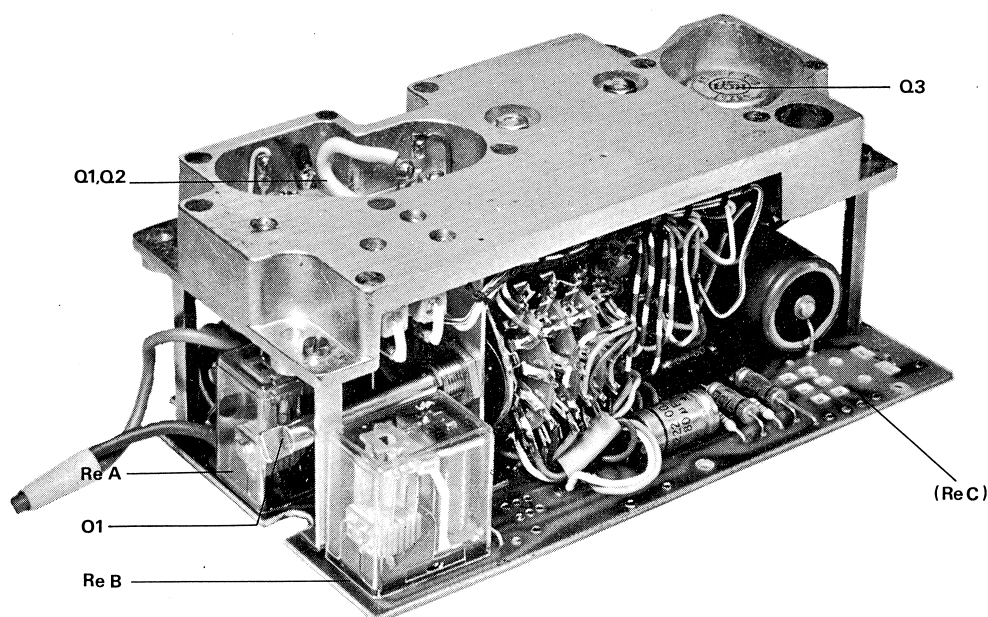
When the group switching feature is provided, the oscillators are divided into two groups - A and B. Group A covers channels 1-8, group B comprising channels 9-12. Each group has a common minus lead which - via the contacts of the switch relay - is always open for one group when it is closed for the other one. The group switching relay is not operated when channels 1-8 are in use.

For channels 9-12, the relay is operated, being energized via an extra contact pair on the channel switch. This will cause the relay contacts in the minus lead of group A to break, instead causing those of group B to make.

The crystal oscillator units for the first four and the last four channels have pairwise common chassis leads, in this sequence: 1+9, 2+10, 3+11, and 4+12. On the channel switch, the same pairwise positions are shorted. But because the group switching relay has opened the minus lead of the unused group of channels, only one transmitter oscillator and one receiver oscillator will be in operation at any time.

If the radio station is equipped with a type PS601 or PS604 power supply unit, the group switching relay (Re C) is inserted in that unit when the group switching function is installed; besides, two straps in the power supply unit are removed (see circuit diagram of PS in question).

Power Supply Unit PS601



The power supply unit is built on a cast chassis and a wiring board. It consists of these units:

- DC Converter with Voltage Switch
- Series Regulator
- Starter and Transmit Relay
- Group Switching Relay (if provided)

The power supply unit primarily serves the purpose of converting 6, 12, or 24 volts from a battery into 24-volt stabilized DC for the transmitter and receiver sections.

Besides, the power supply unit houses such relays as are naturally associated with the power supply.

Mode of Operation

DC Converter

The DC converter is a conventional push-pull oscillator with two transistors in a common-emitter circuit and the transformer inserted in the collector circuit whilst the feedback windings connect to the bases. The converter frequency is between 1 and 4 kc/s.

The transformer primary is composed of four identical centre-tapped windings which are connected either in series or in parallel depending

on the battery voltage. They are in parallel for 6 volts; for 12 volts they are partly in series and partly in parallel; for 24 volts they are in series.

An inductance between the bases of the two transistors is so dimensioned that its core will saturate before that of the transformer. In this way excessive peak currents through the transistors are avoided.

The transformer secondary has a main winding with taps for matching, and an auxiliary winding. The main winding connects to a bridge rectifier. Normally the connection providing the maximum number of turns is used but in cases where most operation occurs at high battery voltages the number of turns must be reduced, in which case the matching tap is used (see circuit diagram). This results in improved efficiency. The secondary auxiliary winding is used for producing a positive auxiliary voltage for the following series regulator and also furnishes power for the starter lamp.

Series Regulator

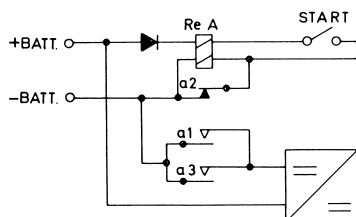
The series regulator consists of a series transistor, a control transistor, and an amplifier transistor.

The base of the amplifier transistor receives, via an alignment potentiometer, a portion of the stabilized output voltage. In the emitter circuit there is a reference diode, and the DC voltage at this point is compared with the base voltage. The collector of the amplifier transistor connects to the base of the control transistor. If the output voltage begins to increase, so will the collector current of the amplifier transistor, and the base voltage for the control transistor will decrease. This will cause the base voltage for the series transistor to decrease and the voltage drop across the latter to increase, thereby causing the output voltage to decrease.

The output voltage is adjusted for -24 volts by means of alignment potentiometer R14.

In order to protect the transmitter-receiver modules against overvoltage in the case of defects in the series regulator, a zener diode across the output of the regulator prevents the voltage from exceeding a certain potential (approx. 30 volts).

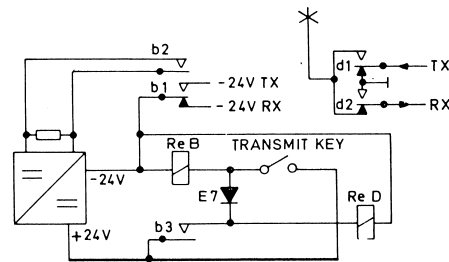
Starter Relay



The starter relay, Re. A, is operated from the control box. It serves the purpose of turning the battery voltage for the power supply unit on and off; this is done via contact sets a1 and a3. The relay has two windings, but only one of them is energized when the relay is operated to start up the equipment, the other winding being short-circuited via one of the contact pairs or the relay (a2). When the equipment has been started, this latter contact set will break, thereby connecting the two windings in series and reducing the holding current.

A diode in series with the relay protects the power supply unit against incorrect battery voltage polarity.

Transmit Relay



Transmit relay (Re. B) is operated from the control box or control equipment. This relay switches the supply voltage back and forth between the receiver and transmitter sections (contact set b1) and short-circuits a feedback resistance in the DC converter during transmission (contact set b2); the latter operation is performed in order to obtain maximum efficiency at varying loads on the converter. When the transmit relay is operated, the antenna switching relay - which is located outside the power supply unit - is energized via the DC path through diode E7 and the transmit button to earth. This occurs simultaneously with the operation of the transmit relay, but since the operating time of the antenna switching relay is shorter than that of the transmit relay, the antenna will be connected to the transmitter before the latter begins to operate and can deliver any power.

On switching to receive, the transmit relay will be de-energized before the antenna relay due to the fact that the latter relay remains operated via contact set b3 of the transmit relay.

Group Switching Relay

If more than 8 channels are provided, the power supply unit will contain a group switching relay. The frequency channels are divided into groups, group A covering channels 1 - 8 and group B channels 9 - 12. Either group of channels has a common earth return lead, and switching of the -24 V potential from one group to the other is performed by means of the group switching relay.

The relay is operated from a channel selector in the control box. For additional information about the channel switching functions see the description of the XS crystal oscillator panel.

Technical Specifications

Supply Voltages

Measured at input terminals.

Supply Voltage	Minimum	Nominal	Maximum
6 V	5.0 V	6.3 V	7.5 V
12 V	10.0 V	12.6 V	16.5 V
24 V	20.0 V	25.2 V	33.0 V

Output Voltage

Regulated. -24V.

Output Voltage Variation

For temperature and load variations

Less than ± 0.6 V.

Output Load

Receive, max. 0.3 A

Transmit, max. 1.4 A.

Output Voltage Ripple

Less than 10 mV p-p.

Current Drain

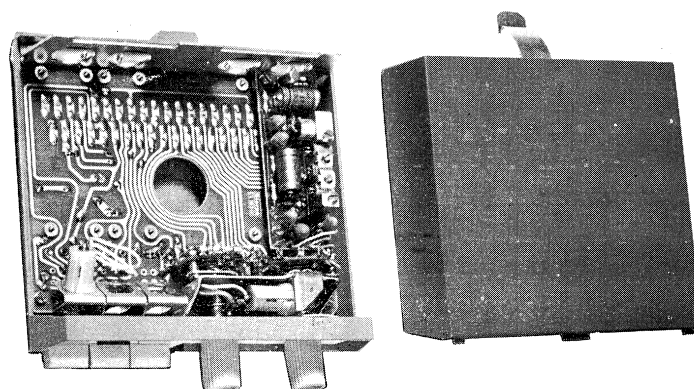
Voltage	Idling	Receive 0.3A	Transmit 1.4A
6.3V	0.3A	2.1 A	10.5 A
12.4V	0.14A	1.0 A	4.8 A
25.2V	0.08A	0.55 A	2.2 A

Converter Frequency

1 - 4 kc/s.

CHAPTER III. ACCESSORIES

Control Box CB601



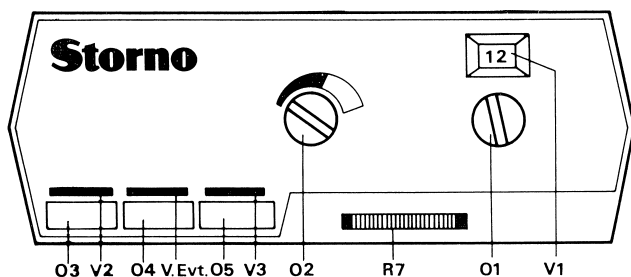
The CB601 control box is intended for remote control of the STORNOPHONE 600 in cases where watertight or specially rugged construction is not a requirement. It can be mounted under the dashboard of a car, hung on a wall, or placed wherever it will not be exposed to physical damage.

The CB601 control box is of die-cast metal. It has a lid which can easily be removed by pressing a spring on the back of the box, thereby providing easy access to all cable connections and circuits. The bottom plate is held by two screws so that it can be easily removed to provide access to the terminal strips to which the control cable, loudspeaker cable etc. are soldered.

Instead of the bottom plate, a loudspeaker can be mounted on the box by means of two screws if desired.

Front Panel

All controls and lamps are located on the front panel of the control box as shown in the drawing.



The position designations, which are also those used in the circuit diagram, cover the following functions:

- | | |
|---------------------------------|--|
| 01. Knob. | Channel selector (for max. 12 channels) with illuminated dial. |
| 02. Knob. | On/off switch and volume control with dial. |
| 03. Self-releasing push-button. | Transmit button (if a built-in tone transmitter is not provided).
Tone button (if a built-in tone transmitter is provided). |
| 04. Self-releasing push-button. | This button turns on the loudspeaker if a built-in tone receiver is provided. |
| 05. Self-releasing push-button. | This button may be used to cut out the loudspeaker if a built-in tone receiver is provided. |
| V1. White lamp. | Start lamp, for use with channel indicator. |
| V2. Red lamp. | Transmit indicator lamp. |
| V3. Green lamp. | Calling lamp for use with selective calling. |
| V. Available. | An additional lamp for some special application can be placed here. |
| R7. Potentiometer. | Squelch control. |

General Functions

Channel Selector

The channel selector (01) has 12 positions, corresponding to the maximum number of RF channels that can be provided. The channel dial, which is illuminated when the radiotelephone is in operation, shows which channel has been selected. The channel switching system uses the group switching method in order to reduce the number of control cable conductors. For this reason the channel selector switch has two sections one of which handles voltage switching between the individual oscillator units whilst the other one performs the group switching function. The channel switching system is described in detail under the crystal oscillator panel, XS.

On/off Switch and Volume Control

The switch (02) controls the loudspeaker volume in six steps. In its extreme anti-clockwise position it turns the equipment off. A semicircular dial above the knob shows how much the volume control is advanced.

Transmit Button

A steering-wheel switch, foot switch, microphone key etc. will usually be preferred as transmit button.

However, button 03 on the control box can also be used as transmit button if no tone transmitter is provided in the box (see under selective functions).

The red transmit indicator lamp shows light while the transmit button is depressed.

Squelch

The electronic squelch system in the receiver can be adjusted with the squelch potentiometer (R7). To do this, turn the potentiometer in a clockwise direction until you hear set noise (hiss); then turn it anti-clockwise until the noise disappears.

Selective Functions

Turning the Loudspeaker On and Off

When selective calling is used, the loudspeaker will be operative during incoming calls. The loudspeaker can be cut out on termination of calls by depressing button 05. Only calls intended for the operator will then turn the loudspeaker on.

If you want to monitor the channel for traffic, you turn the loudspeaker on by depressing button 04. The channel should always be monitored before pressing the transmit button, and for this reason the tone receiver unit incorporates a circuit to prevent operation of the transmitter before button 04 has been depressed and the loudspeaker turned on.

Tone Transmission

Button 03 is used to turn on the built-in tone transmitter, in which case an external push-button is used as transmit button (for instance a steering-wheel button or microphone key).

Calling Lamp

The green calling lamp (V3) is installed only if selective equipment is provided. It shows light when selective calls are received and transmitted and in the former case continues to show light until the loudspeaker is turned off by depressing button 05.

Built-in Units

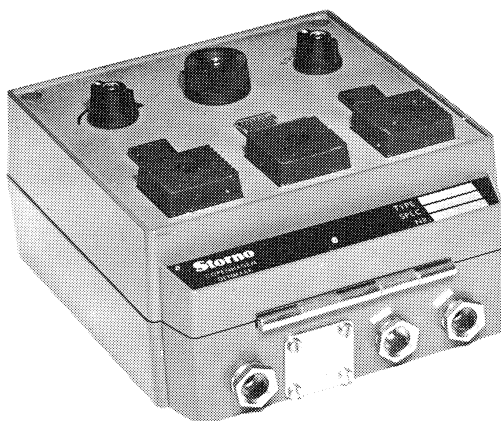
The control box houses the receiver audio output amplifier unit, AA602, which is screw-mounted on top of the wiring board of the box so that it becomes accessible on removal of the lid.

The audio output amplifier is described separately in this Chapter.

The control box also accommodates a tone-transmitter and a tone-receiver unit. These units are similarly screw-mounted on top of the wiring board of the box.

Additional information about the installation of tone equipment is contained in a separate manual covering tone equipment for the STORNOPHONE 600.

Control Box CB602



Control box Type CB602 is a rugged watertight box for remote control of a CQM600 or CQF600 radiotelephone, the latter being employed as a mobile station.

The control box is of grey die-cast light-alloy metal. It has sturdy controls. It can be mounted on a plane surface, wall etc. by means of the four screws supplied with it.

The box is divided into two sections, a lid and a bottom, which are hinged together below and held together by two screws at the top. On loosening these screws, the lid can be tilted down, thereby providing easy access to the circuitry and to the terminal strips to which the control cable, loud-speaker cable etc. are soldered.

The bottom of the box has three cable entries with associated gland nuts, and a covered cut-out in which a handset connector socket may be installed if desired.

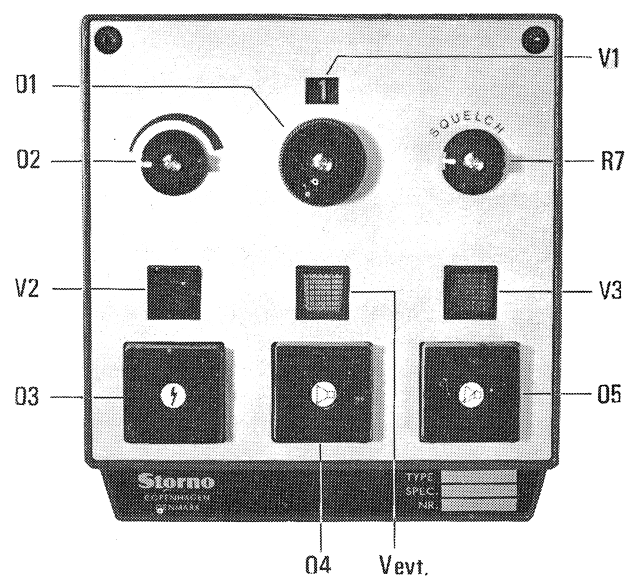
Front Panel

All controls and lamps are located on the front panel as shown in the sketch.

The position designations, which are also those used in the circuit diagram, cover the following functions:

- 01. Knob.
Channel selector (for max. twelve channels) with illuminated dial.
- 02. Knob.
Combined on/off switch and volume control with dial.
- 03. Self-releasing push-button.
Transmit button (without built-in tone transmitter).
- 04. Self-releasing push-button.
"Speaker In". This button cuts in the loud-speaker if a built-in tone receiver is provided.
- 05. Self-releasing push-button.
"Speaker Out". This button may be used to cut out the loudspeaker if a built-in tone receiver is provided.

- V1. White lamp.
Start lamp, for use with channel indicator.



- V2. Red lamp.
Transmit indicator lamp.
- V3. Green lamp.
Calling lamp to indicate incoming selective calls.
- V. Available.
An additional lamp for some special application may be placed here.
- R7. Potentiometer.
Squelch control.

General Functions

Channel Selector

The channel selector (01) has 12 positions, corresponding to the maximum number of RF channels that can be provided. The channel dial, illuminated when the radiotelephone is in operation, shows which channel has been selected. The channel switching system uses the group switching method in order to reduce the number of control cable conductors. For this reason the channel selector switch has two sections one of which handles voltage switching between the individual oscillator units whilst the other one performs the group switching function. The channel switching system is described in detail under the crystal oscillator panel, XS.

On/off Switch and Volume Control

The switch (02) controls the loudspeaker volume in six steps. When turned fully left, it switches the equipment off. A semicircular dial above the knob indicates the volume control setting.

Transmit Button

An external switch (such as a microphone switch, handset key etc.) will usually be preferred for use as a transmit button.

However, button 03 on the control box can also be used as transmit button if no tone transmitter is provided in the box (see under Selective Functions below).

The red transmit indicator lamp shows light while the transmit button is kept depressed.

Squelch

The electronic squelch system in the receiver can be adjusted with the squelch potentiometer (R7). To do this, turn the potentiometer in a clockwise

direction until you hear set noise (hiss); then turn it anti-clockwise until the noise disappears.

Selective Functions

Cutting the Loudspeaker In and Out

When selective calling is used, the loudspeaker will be operative during incoming calls. The loudspeaker can be cut out on termination of calls by depressing the button 05. Only calls intended for the operator will then cut the loudspeaker in.

If you want to monitor the channel for traffic, you cut in the loudspeaker by pressing the button 04. The channel should always be monitored before pressing the transmit button, for which reason the tone receiver incorporates a circuit to prevent operation of the transmitter before the button 04 has been depressed and the loudspeaker cut in.

Tone Transmission

In this case the button 03 is used to switch on the built-in tone transmitter, and an external push-button is used as transmit button (for instance a microphone switch or handset key).

Calling Lamp

The green calling lamp (V3) is installed only if selective equipment is provided. It shows light when selective calls are received and transmitted and in the former case continues to show light until the loudspeaker is cut out by depressing the button 05.

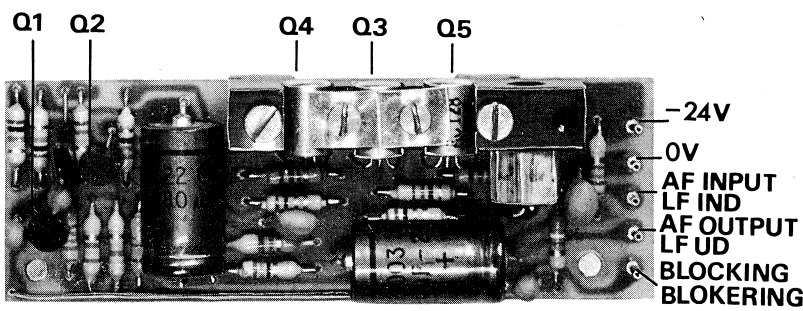
Built-in Units

The control box houses the receiver audio output amplifier, AA602, which is screw-mounted to the right on the bottom of the box so that it will become accessible on removal of the lid. The audio amplifier is described separately in this chapter.

The control box will also accommodate a tone transmitter and tone receiver - and an alarm circuit AC683. These units are similarly mounted on the bottom plate whilst the alarm circuit is mounted on top of the audio amplifier unit.

Additional information about the installation of tone equipment is contained in a separate manual covering tone equipment for the STORNOPHONE 600.

Audio Output Amplifier AA602



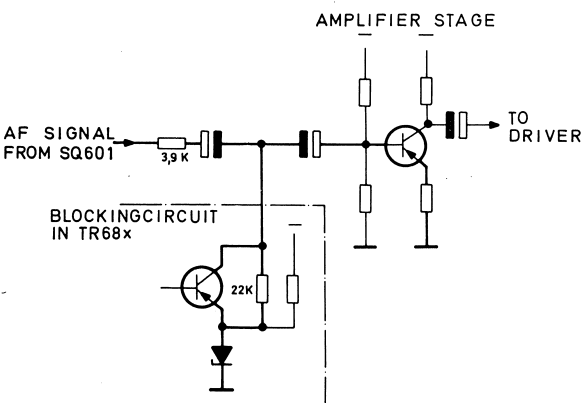
The audio output amplifier is built on a wiring board. It consists of these stages:

- Blocking attenuation circuit
- Pre-amplifier stage
- Driver
- Complementary output stage with temperature compensator.

The audio output amplifier is a transformer-less push-pull amplifier which is capable of delivering 2 watts of power output. This unit is located in the control box.

Mode of Operation

The blocking attenuation network in the input circuit of the audio output amplifier is used only if a selective tone receiver is provided, in which case the attenuation network (a T-network) is made up of the pre-amplifier input impedance, a series resistor, and the output impedance of the tone-receiver blocking circuit; the latter impedance should be less than 1.5 ohms if the desired blocking attenuation is to be achieved (see sketch below).



The signal is fed to the output stage via the pre-amplifier stage and the driver stage, both of which receive negative feedback voltage from the output stage. Temperature compensation of the output stage is accomplished by biasing a transistor connected between the bases of the output transistors. The type of compensation employed is base-emitter voltage compensation. The output stage operates in Class B push-pull in a common-collector circuit. It is transformer-less, with a loudspeaker load of approx. 15 ohms.

Warning Never short-circuit the loudspeaker output (terminals 2 and 4) as this will cause permanent damage to transistors.

Reducing the Input Sensitivity

If a reduction in the output amplifier sensitivity is desired, a 1/8-watt resistor (see table below for resistance value) may be inserted between terminal 3 of the unit and the wiring board in CB60x.

INPUT SENSITIVITY FOR 2 WATTS OUTPUT	RESISTANCE VALUE
+3 dBm	22 k ohms
0 dBm	12 k ohms
-3 dBm	6.8 k ohms
-6 dBm	2.7 k ohms
-9 dBm	0 ohms

Technical SpecificationsSupply Voltage

24 V $\pm 5\%$.

Resistance in Power Supply Cable

R_{cable} : max. 14 ohms.

Current Drain

At 24V: without signal	20 mA
at 2 watts output	175 mA
blocked	20 mA

Power Output

Max. 2 watts.

Loudspeaker Impedance

15 ohms.

Input Impedance

6.5 k ohms.

Input Sensitivity

For 2 watts into 15 ohms and $R_{\text{cable}} = 0$ ohms.
Better than -9 dBm.

Frequency Response

Measuring level 1W (ref. 1000 c/s): 300 -
3000 c/s +0.5 dB -1.5 dB.

Distortion

Less than 5%.

Hum and Noise

Attenuated 60 dB.

Blocking

Earthing the blocking lead through tone receiver TR68x or 1.5-ohm resistor: 50 dB.

Dimensions

28 x 80 mm.

Fixed Microphone MC601



Microphone MC601a

The MC601a microphone is designed for fixed mounting and a speaking distance of approx. 30 - 40 cm. The microphone housing contains a 600-ohm microphone cartridge and a Type AA604 50-dB amplifier with integrated circuits. This microphone may be used with the CB601 control box.

Fixed Microphones MC602, MC603, MC604

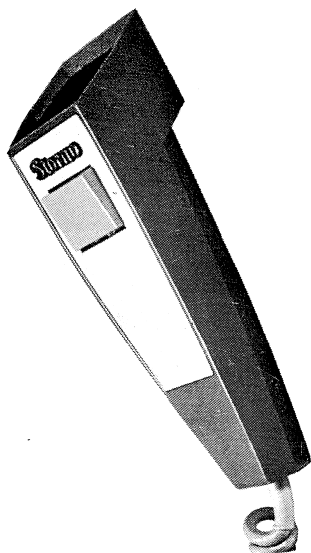


Microphones MC602a, MC603a, and MC604a

These microphones are identical with the Type MC601a in regard to technical details and operation; however, they have goosenecks of different lengths.

MC602a	11-cm gooseneck
MC603a	21-cm gooseneck
MC604a	41-cm gooseneck

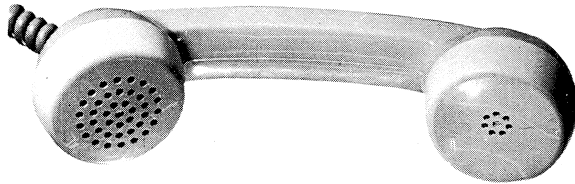
Fist Microphone MC606



Microphone MC606a

The MC606a microphone is a fist microphone. A transmit button is provided on the housing. The MC606 microphone contains a 600-ohm dynamic microphone cartridge and a Type AA606 50-dB integrated amplifier. The fist microphone is used with the CB601 control box.

Handset MT601



Handset MT601

The MT601 handset is a conventional handset with transmit key. It contains a telephone cartridge and a microphone cartridge with a built-in amplifier.

The MT601 handset may be used with the CB601 control box.

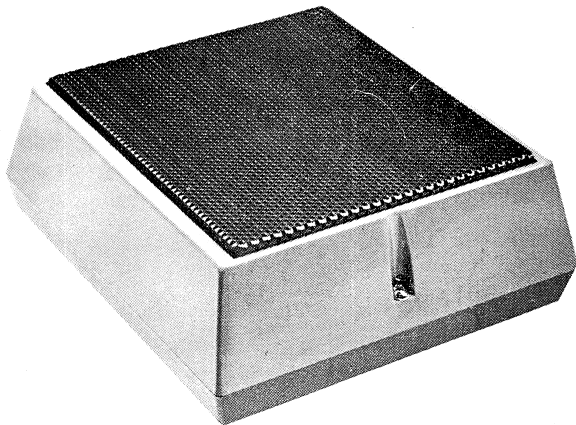
Handset MT602

Handset MT602

The MT602 handset is a watertight handset with transmit button. It contains a telephone cartridge and a microphone cartridge with a Type AA605 one-stage transistor amplifier which

provides approx. 20 dB gain. The MT601 handset may be used with either the CB601 or the CB602 control box.

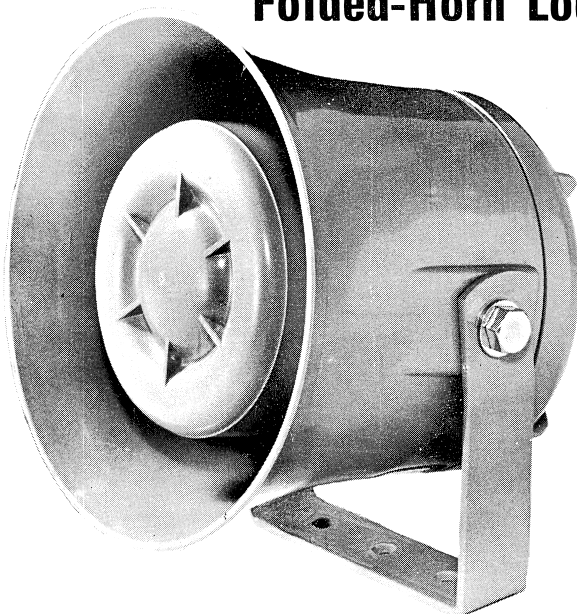
Loudspeaker LS601



Loudspeaker LS601a

The Type LS601a loudspeaker is a 2-watt 15-ohm loudspeaker mounted in a plastic housing. It may be mounted wherever convenient (mounting hardware is supplied). It can also be mounted on the CB601 control box.

Folded-Horn Loudspeaker LS602



Folded-Horn Loudspeaker LS602

The Type LS602 folded-horn Loudspeaker is a watertight high-efficiency loudspeaker with pronounced directional properties. For this reason it is excellently suited for outdoor mounting, for instance in conjunction with motorcycle installations.

Technical Data

Impedance: 20 ohms

Power capacity: 10 watts

Lower limiting frequency: 560 c/s

Dimensions: 150-mm dia. x 140 mm.

CHAPTER IV. INSTALLATION

A. General

Introduction

It is most important that the equipment is properly installed in accordance with the instructions in this chapter. The performance of the equipment can be seriously impaired if the installation is carried out without due care.

The instructions given in this chapter should be read and followed carefully by the personnel installing the equipment.

It is not possible to give precise instructions for each particular vehicle, as there are so many different types and different customers who have different requirements.

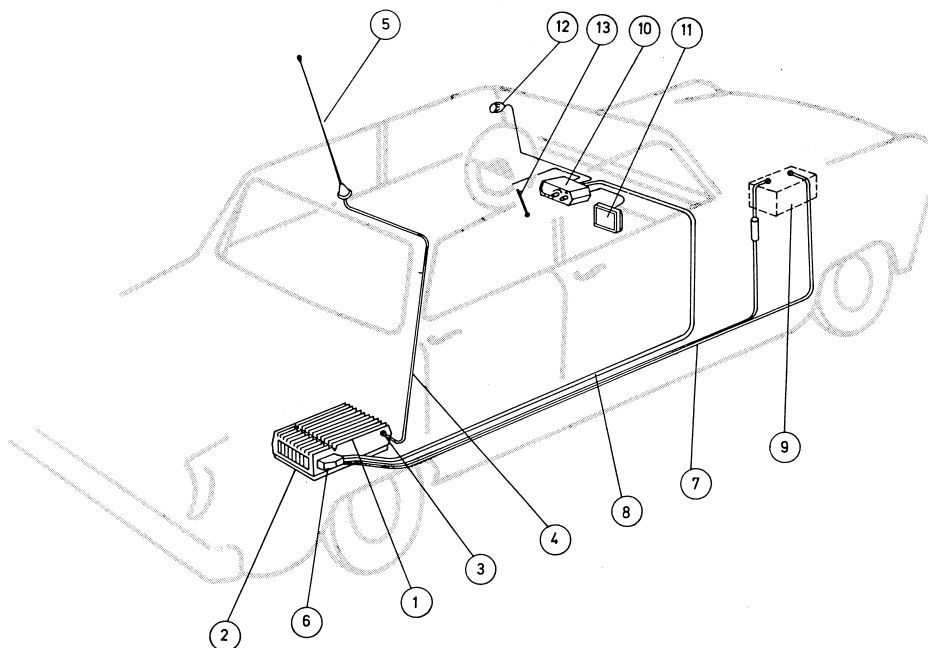
Apart from vehicles, there are special problems

associated with the installation of the Sornophone 600 in vessels, fork-lift trucks, coaches, locomotives etc.

Inspection

Each equipment, with its accessories, should be checked against the packing note or invoice on arrival, for possible damage or short shipment. Sorno should be notified immediately of any damage or shortage.

If equipment is returned to Sorno under guarantee or for repair, the original expanded polystyrene packing should be used. The test sheet should also be enclosed.



1. Transmitter/receiver
2. Cradle or girth
3. Antenna connector
4. Antenna cable
5. Whip antenna
6. Cable connector
7. Battery cable

8. Multicore cable between equipment and control box
9. Vehicle battery
10. Control box
11. Loudspeaker
12. Microphone
13. Steering wheel switch

Chapter IV. Installation

Basic Items

In order to carry out a satisfactory installation the following items are required:

1. Transmitter/receiver unit
2. Mounting cradle or girths 37.065 or 37.072
3. Standard set of installation cables
4. Standard set of accessories comprising a connector, a fuse holder, fuse and cable shoes.
5. Control box (type CB 601 or CB 602).
6. Loudspeaker, microphone or handset or other system of microphone and steering wheel switch.
7. Antenna base and whip.

An instruction sheet is automatically sent with each major accessory.

Standard Procedures

Before the installation commences, the cable runs should be decided before the work begins. The following points should be noted:

- a. The cables should be as short as possible.
- b. The cables should be kept away from moving parts such as the handbrake, shock absorbers etc.
- c. The cables should not be run near the engine or the exhaust manifold and pipe.
- d. The cables should be run, wherever possible, in parallel with existing cable forms and through the same holes in the chassis members. Suitable grommets must always be used if special holes are drilled in the metalwork.
The cable should not be run externally underneath the vehicle. Cable cleats should be used wherever the cable is likely to sag e.g. on long straight runs on coaches etc.
- e. The length of battery cable on 6 volt systems must not exceed 12 feet. (4 metre).

- f. The in-line fuse should be placed as near to the battery as possible.
- g. Ensure that the cables are not strained, sharp bends are to be avoided.

Soldering

For soldering, the multicore cable to the control box a 25 watt iron should be used, but a 65 watt iron should be used for the connector. Ensure that the coaxial braiding is firmly soldered to the connector, however, care must be taken to prevent the insulation melting.

Temperature

The circuits on the Stornophone 600 are designed to operate over a wide range of temperature, and the case is designed to provide maximum heat loss without louvres or vents.

The surrounding temperature should not normally exceed the limits - 15°C to + 50°C but the equipment will continue to operate within the range -30°C to +60°C, for a limited period when these temperatures are reached e.g. on a winter night or a summer day.

The radio equipment can be stored at a higher or lower temperature without damage.

Care should be taken, therefore, before commencing the installation to choose a position for the radio equipment which is protected as far as possible from extreme heat or cold. In cases of operation in warmer climate, adequate ventilation must be provided so that the cabinet can operate as a heat sink.

Special Installations

In cases where special installations are required e.g. where shock absorbers are required, or an installation on a solo motorcycle is required, then special installation instructions will be provided with the goods.

B. Installation of the Radio Equipment**Selection of Position**

When selecting a position in the vehicle for installing the transmitter/receiver unit, several important points should be noted. As mentioned

in the previous section, the unit must conduct the heat away, therefore, the floor of the boot is not the best place as the transmitter/receiver can be covered with baggage. It is better to

Chapter IV. Installation

mount the set on the sides of the boot or on the bulkhead at the back.

In larger trucks there is usually sufficient space under the driver's seat to install the unit. In vessels and locomotives there are many possibilities and, therefore, a position should be chosen which gives maximum protection against direct sunlight or direct rain and spray. Sufficient space must be left to enable a service engineer to remove the equipment and the cables should be left sufficiently free to permit the equipment to be withdrawn from its cradle or girths.

Installation of Transmitter/Receiver Unit

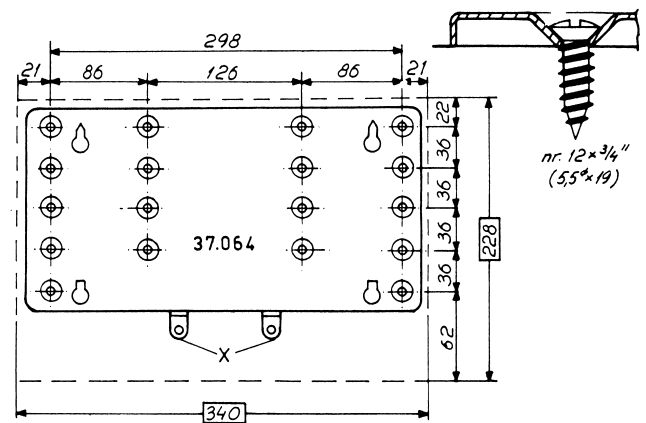
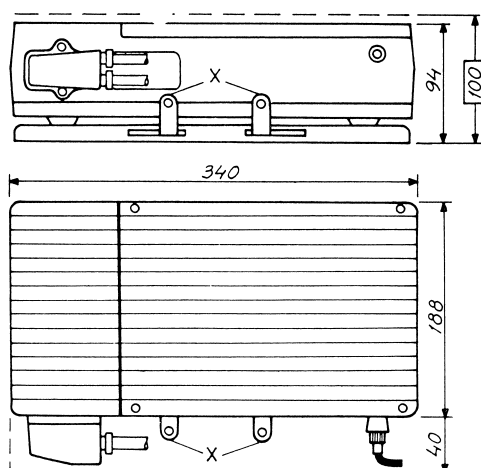
There are two methods of securing the transmitter/receiver unit and the appropriate material is supplied in each case:

- 37.065 Cradle complete with fixing screws
- 37.072 Girths with brackets and fixing screws.

The cradle permits installation in any position, whereas the girths can only be used when the surface is flat and level.

The cradle itself is used as a template for drilling the fixing holes at the position chosen. The cradle has a series of countersunk holes so that it may be affixed at the suitable points. A selection of self-tapping screws are provided. The number of screws used to hold the cradle depends on the positioning of the cradle, but the minimum number of screws should be four, one at each corner or as far apart as possible.

The drawing gives the dimensions of the set and the cradle:



All dimensions are in millimetres.

The transmitter/receiver unit is fitted into the cradle by first bringing the two locking bars (marked X on the diagram) together and then inserting the four feet on the base of the equipment in the four slotted holes on the cradle. The locking bars are then moved outwards to secure the equipment firmly in the cradle.

Cables

The standard installation kit (19.063) consists of the following cables:

Antenna cable, 4 yards, (4 metres) type RG58/U or UR76 (Storno type 075.5013).

Battery cable, 8 yards, (8 metres), PVC covered, $2 \times 4 \text{ mm}^2$ (Storno type 073.5022).

Control cable, 6 yards, (6 metres), 26 way PVC covered, $4 \times 0,25 \text{ mm}^2 + 22 \times 0,125 \text{ mm}^2$, (Storno type 074.5014).

These lengths will be sufficient for most standard installations for private cars and small trucks. Extra lengths of cable may be supplied on request.

Branching Filter Assembly BF600

If the radio equipment operates in the duplex mode from a single antenna, a branching filter, BF600 is inserted between the transmitter/receiver unit and the antenna.

The branching filter, which is contained in a die cast casing similar to the transmitter/receiver unit is supplied complete with suitable coaxial leads and terminations for connection to the radio equipment and antenna.

The filter unit can be installed, as illustrated, underneath or at the side of the transmitter/receiver cabinet, depending on the space available.

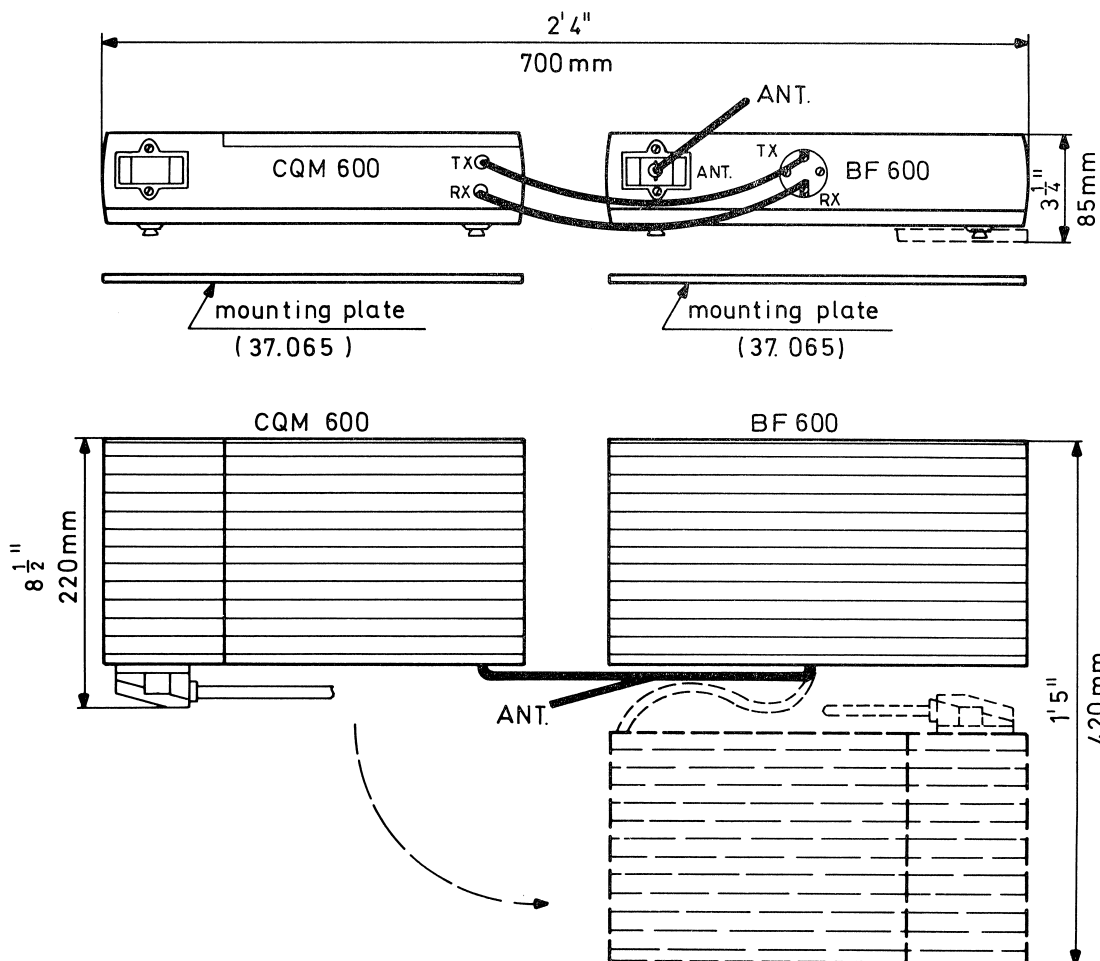
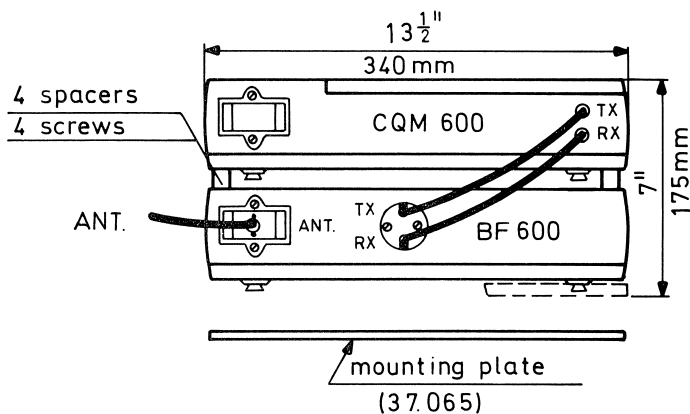
If the units are to be installed on top of each other, they are anchored together by means of the 4 spacers and screws which are supplied with the unit. The branching filter, being the lower unit is then inserted and locked into position in the standard mounting plate (37.065).

The mounting plate is supplied as part of the standard accessory kit with the transmitter/re-

ceiver unit and the method of fixing to a vehicle is described earlier in this chapter.

If the units are to be installed side by side, they must be positioned so that the interconnecting cables can be fitted to the units without strain. In this case 2 mounting plates are required.

The additional mounting plate should be specified when ordering the equipment.



Chapter IV. Installation

Connectors (17.014)

A plastic bag is supplied containing the following items:

Antenna connector UG88/U

(Storno type 41.5120)

Waterproof multi-way connector

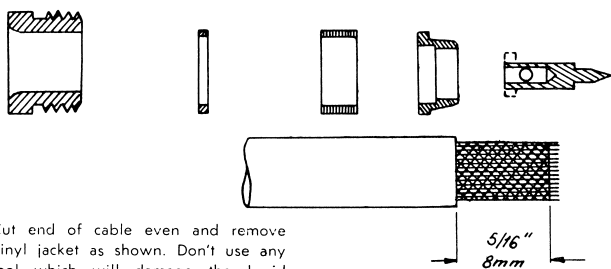
(Storno type 41.149)

Fuse holder with fuse

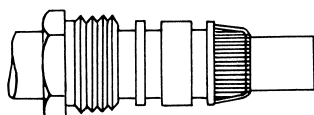
Battery cable shoes

The assembly instructions for these items are given below:

Antenna Connector



Cut end of cable even and remove vinyl jacket as shown. Don't use any tool which will damage the braid wires.

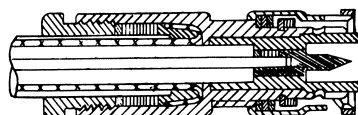
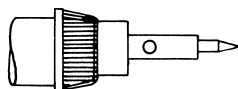
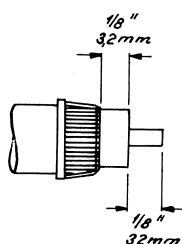


Comb out braid wires and fan out over end of cable. Slide the different parts on vinyl jacket in the order shown.

Fold braid wires back on clamp in one layer, and keep wires from crossing. Trim braid wires as shown. Bare $\frac{1}{8}$ inch of center conductor without nicking it. Do not use a pair of deinsulating pliers.

Tin center conductor and female contact carefully together. Do not use any soldering fluid and cool in spirit. Scrape off superfluous resin and solder with a sharp knife. Check the centering of the male contact.

Slide connector body carefully into end of cable and tighten moderately with a wrench.



Multi-way Connector

The multi-way connector (41.149) has two cable entries for the battery cable and control cable respectively. Due to the proximity of the pins to each other, it is advisable to fit short insulating sleeves on the individual wires before soldering. The sleeves are then pulled down over the pin when the connection is made. The

control cable is soldered to the pins on the connector as indicated in the table overleaf.

Terminal	Colour	Terminal	Colour
B	green/white	T	yellow/grey
F	green/grey	X	brown/white
L	red/yellow	BB	brown/grey
R	black/yellow	FF	grey/white
V	violet	LL	green/red
Z	grey/red	A	green
DD	grey	E	green/brown
JJ	orange	K	red
NN	yellow	P	blue
D	yellow/white	U	brown
J	yellow/green	Y	black
N	yellow/brown	CC	red/brown
		HH	blue/brown
		MM	white

NOTE: Due to difficulty of supply, some control cable supplied may not correspond with the table given above. In all cases, irrespective of the colour wire, the terminals will match on the connector and control box i.e. DD is wired to DD, and K to K etc.

The equipment is sometimes supplied with the multicable already soldered to the connector. The shorting links should be soldered to terminals one of them joining AA, EE and KK together, the other one joining H, M, and S together as shown according to the operating voltage required:

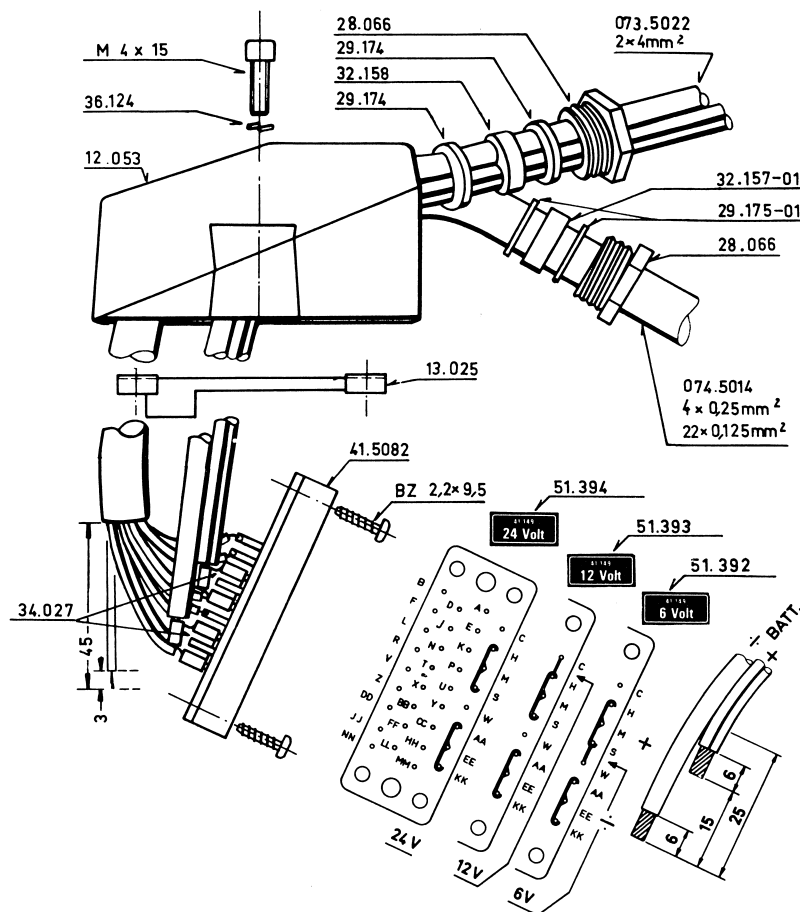
For 6 volts: join terminals S and W

For 12 volts: join terminals H and C

For 24 volts: no connections.

After threading on the gland nut and the packing washers, the battery cable is fed through the entry as shown on the diagram. The negative cable is soldered to the shorting link joining AA, EE, KK whilst the positive lead is connected to the shorting link joining H, M, S. The connector is pulled into the housing and the key way 13.025 is fitted into position before the connector is screwed to the housing by means of the two screws. The battery voltage that is being used is marked on the connector by affixing the appropriate voltage label to the countersunk space on the back of

Chapter IV. Installation



the connector housing. Before affixing the label ensure that the space is clean and grease free. If not clean with petrol or other grease remover.

Fuse Holder and Cable Shoes

In cars with negative to chassis the fuse holder (46.5010) is inserted in the positive lead of the battery (the marked cable) as close to the battery as possible. If the car has positive to chassis the fuse is inserted in the negative lead instead.

The lead is cut, bared and fitted to the two halves of the fuse holder.

The label shown below is attached to the fuse holder. The end of the battery cable is prepared and the battery shoes are soldered to the cable.

6V	16A
12V	6A
24V	3A

C. Installation of Standard Control Equipment

General

For normal passenger car use, where there is no special requirement for robust or splash proof equipment, the following items may be used:

Control box	CB 601
Loudspeaker	LS 601
Fixed Microphone	MC601, MC602, MC603, MC604
or	

Steering Column

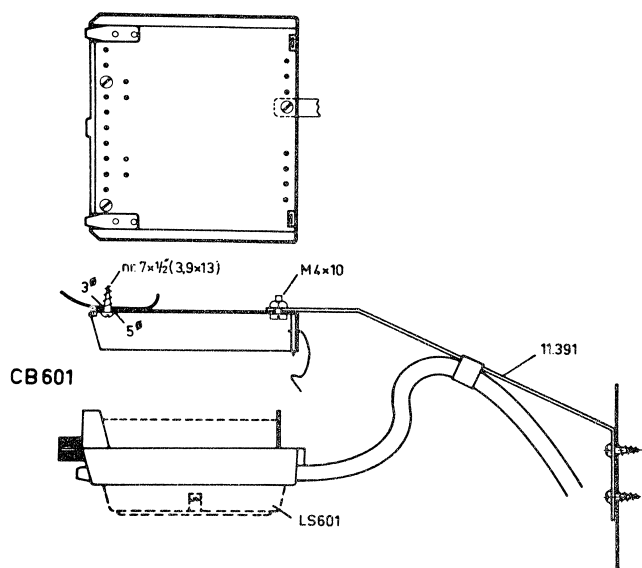
Microphone	MC 607
or	
Hand set	MT 601
or	
Fist Microphone	MC 606a

Steering wheel switch SU 601 or SU 602 (used with fixed microphone only if required).

Control Box CB601

The control box CB 601 can be fitted under the car dashboard, vertically on the facia, or any other position convenient for the operator. The control box must be fitted firmly in the position chosen. The material to which the control box is fitted must be capable of carrying the load imposed by the weight of the control box. If a flat surface cannot be found, then the control box may be installed in the manner shown below, by using the supporting strips 11.391 supplied.

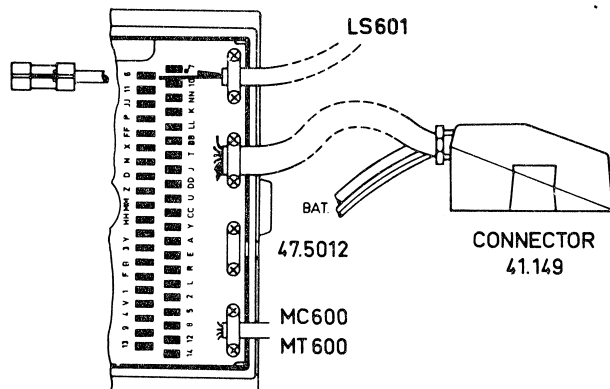
The back plate is used as a template. A line of drilling points is given as a guide and the hole should be drilled to provide the most secure fixing, using support strips as necessary.



Control Cable

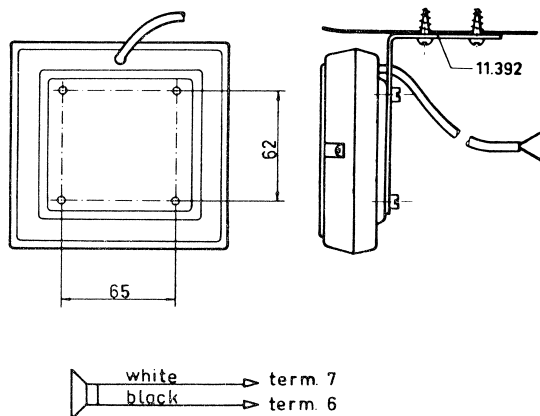
The cable is cut to length and the wires are bared. Each wire is soldered to the terminals on the terminal strip in accordance with the table on page 4 - 4.

Terminals are provided on the control box for the addition of various types of microphone, loudspeaker, alarm circuits etc.



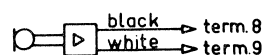
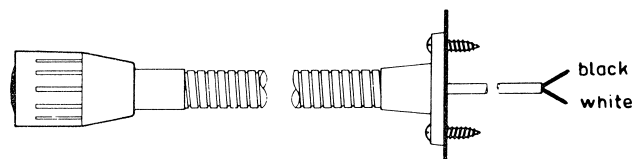
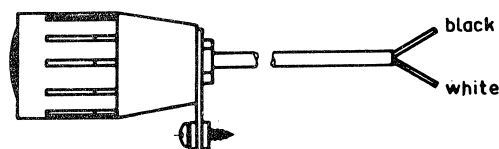
Loudspeaker LS601

The loudspeaker can either be mounted on the base of the control box or as a separate unit connected to the control box. For integral mounting, the base plate on the control box is removed and the loudspeaker is fitted in its place. For independent mounting, the loudspeaker may be mounted on a flat surface or by means of the support strips 11.391 as illustrated.



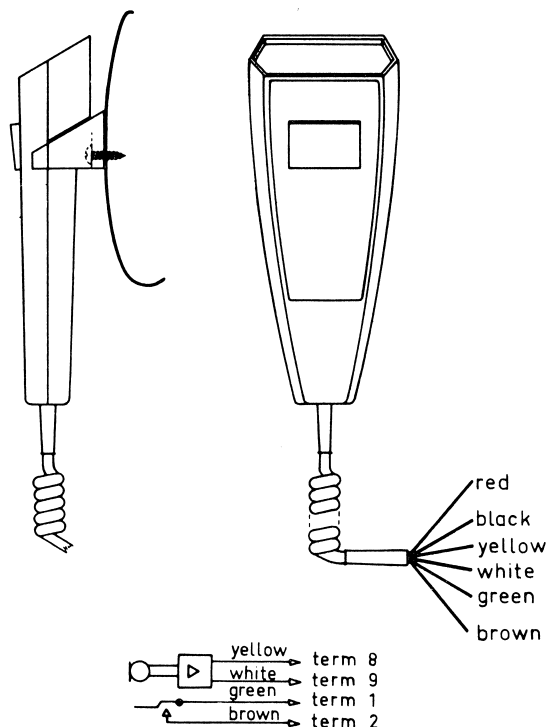
Fixed Microphone MC601, MC602, MC603, MC604

The fixed microphone is fitted in a suitable position so that the normal speaking distance is 30 - 40 cms (12 - 16 inches). The most convenient position in passenger cars is the corner of the windscreen on the drivers' side.



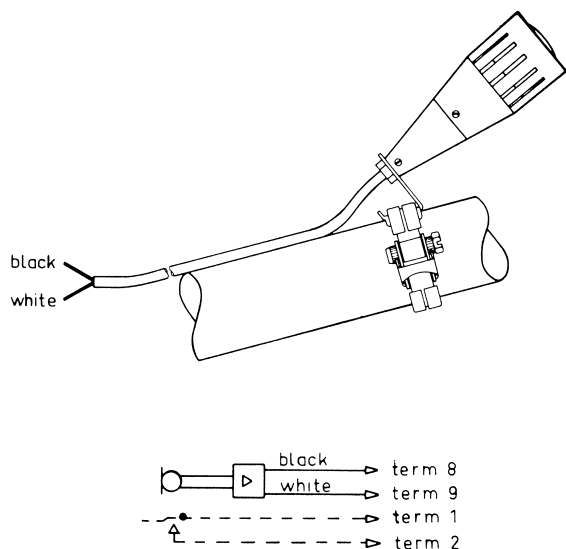
Fist Microphone MC606

The fist microphone is fitted in a convenient position near the control box and within easy reach of the operator. The stowage is used as a template for the fixing screws. The leads from the microphone are connected to the control box as indicated in the diagram.



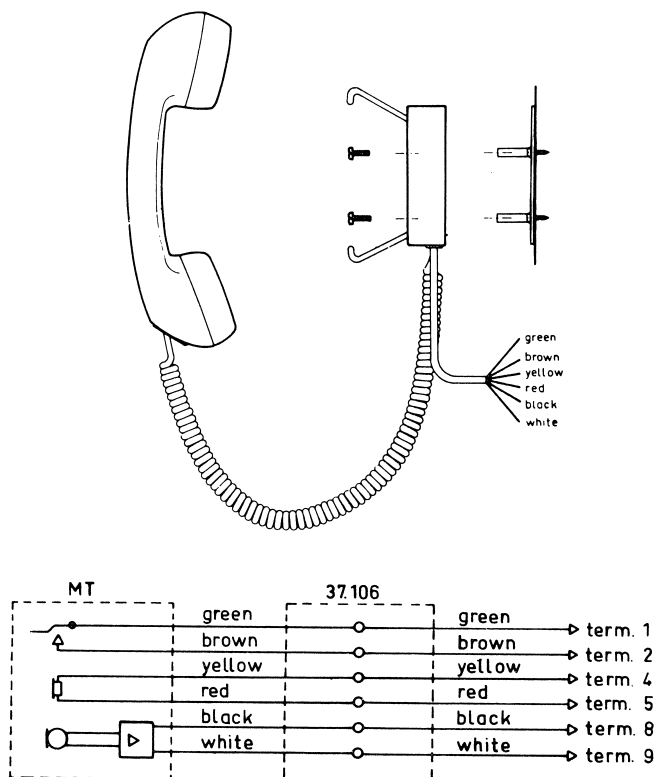
Steering Column Microphone MC607

The steering column microphone is fitted as shown and the leads are connected to the control box as indicated in the diagram.



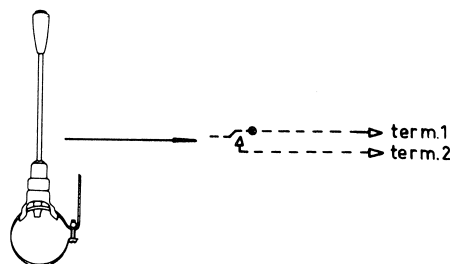
Handset MT601

The handset and its stowage is fitted in a convenient position near the control box, and within easy reach of the operator. The leads from the handset are connected to the control box as indicated on the diagram.



Steering Column Switch

The steering column switch is used as a keying switch when the microphones MC601, MC602, MC603, MC604, and MC607 are used. The leads from the switch are connected to the terminals on the control box as indicated. The keying circuit must be isolated from the chassis.



D. Installation of Waterproof Control Equipment

In cases where special requirements have been made for equipment being watertight, salt-resistant and able to withstand rough handling, the following parts are required for the installation:

Control box	CB 602
Handset	MT 602
Loudspeaker	LS 602

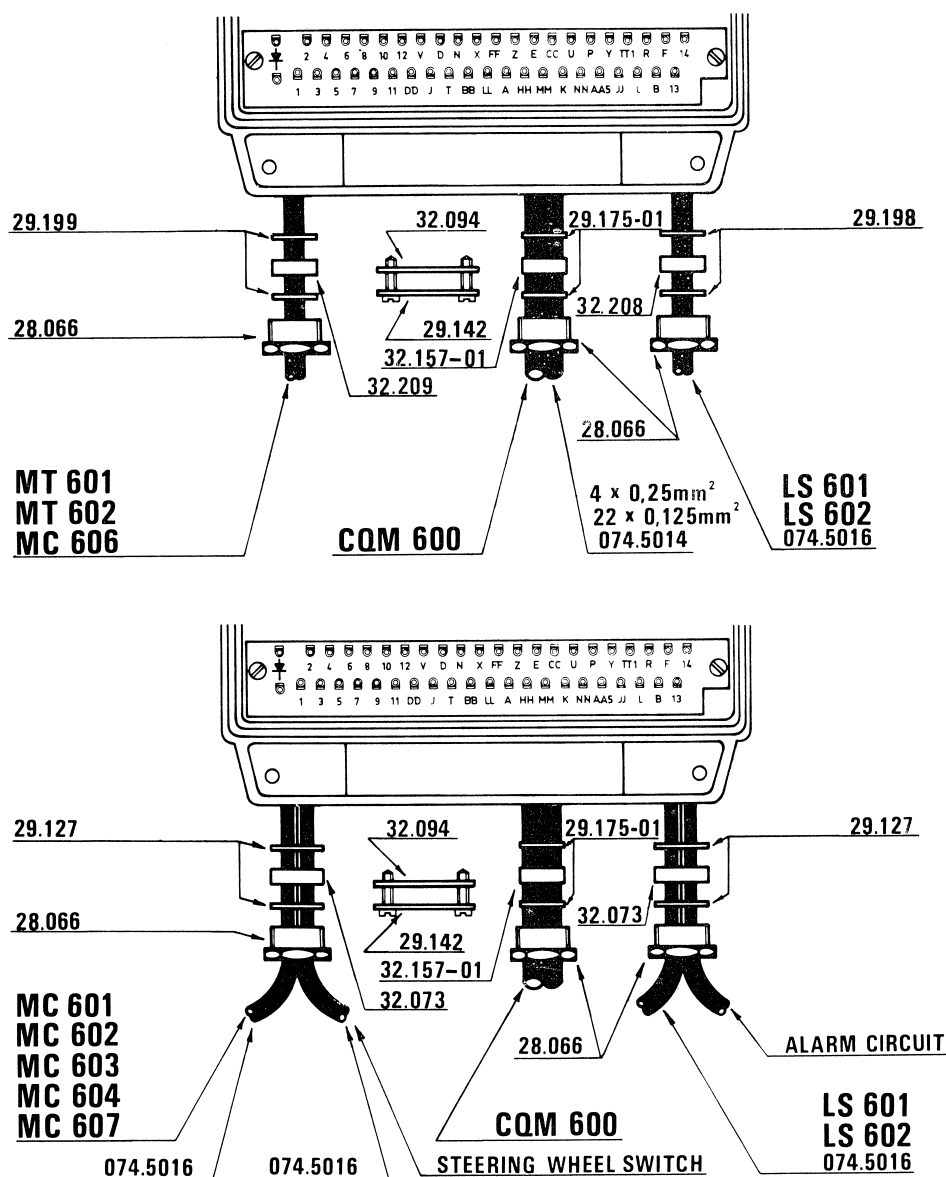
Control Box CB602

The control box CB602 is watertight and intended to be mounted on a plane surface, It may also be

mounted on a supporting bracket for use on motorcycles, fork-lift trucks etc.

By unscrewing the two screws at the top of the control box, the front can be hinged down revealing the terminal strip, to which the multi-core cable is attached.

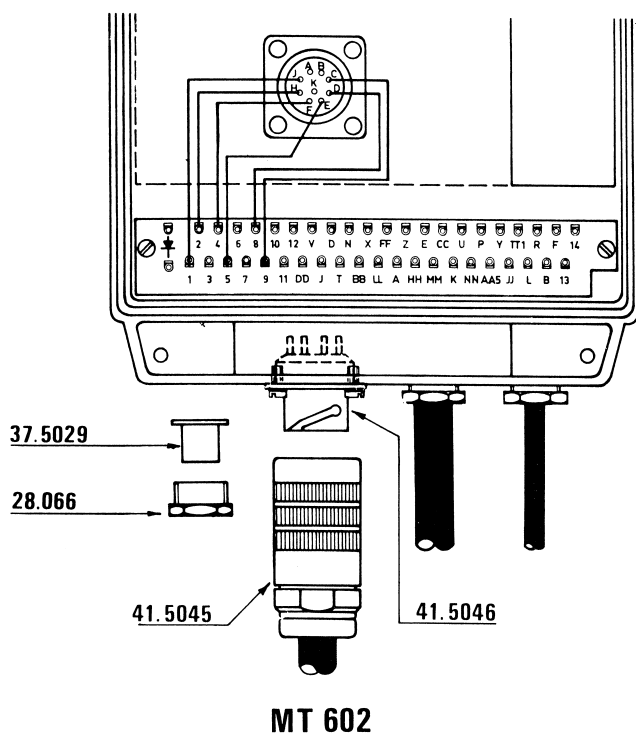
The cables are fed in through the apertures at the base of the body of the control box in accordance with the diagram below. The leads are stripped and soldered to the terminals as shown on the table on page 4-4. The accessories are fitted as detailed below.



Assembly of Connector for MT602

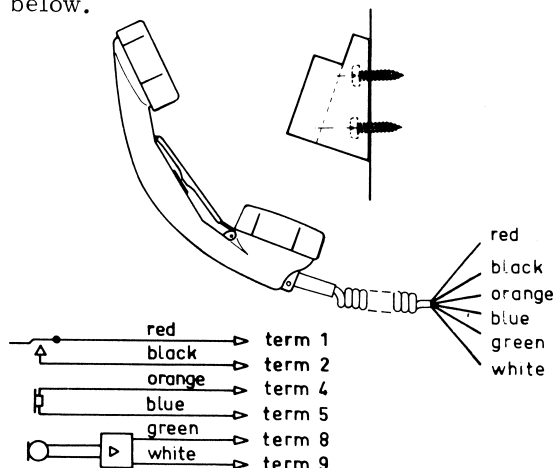
The handset MT602 is designed for use with the control box CB602 and the lead from it is normally soldered to the common terminal board in the control box.

However, it is possible to supply a detachable handset cord and a socket in the space provided on the control box. The blanking plate is removed and a socket 41.5046 is inserted in the hole. Wire up the socket in accordance with the diagram given below, and fit the bung 37.5029 and captive gland nut 28.066 to cover up the hole normally used for the handset cord.



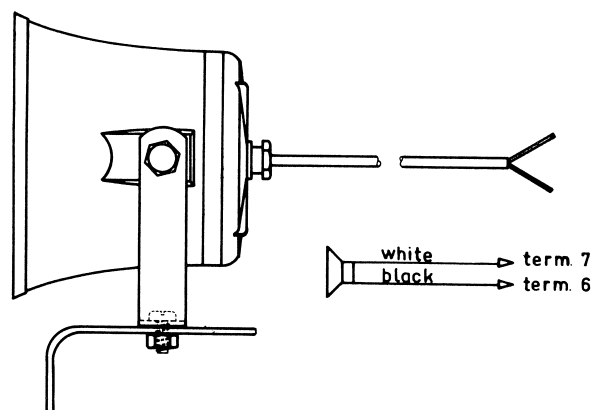
Handset MT602

The handset and its holder should be securely fixed in a suitable position near the control box. The connections for the control box are given below.



Waterproof Loudspeaker LS602

The waterproof re-entrant horn loudspeaker is designed for outdoor use. A bracket is supplied, together with fixing screws to enable the loudspeaker to be mounted in a convenient position. The lead is fed into the control box and the connections are made in accordance with the diagram below.



E. Standard Antennas

The antenna should be placed as high as possible and free from obstruction in order to obtain the best possible matching and radiation. The antenna should be placed on the roof of the vehicle. Mounting the antenna on a fender or on the lid of the luggage compartment should be avoided as undesired directivity and poor impedance matching will be introduced.

Antenna Base

The coaxial cable can be attached to the base in two ways, either by using a special crimping tool as shown, or the conventional soldering method.

Chapter IV. Installation

Procedure

Cut the coaxial cable as shown below, taking care not to damage the inner conductor or the braiding.

Thread the grommet 32.5033, the bush 31.346, the crimping tube 31.347, on the cable in that order.

Fit the collar 31.344 between the braid and the insulating material, and then thread the insulating washer 12.114 and the final collar 31.345 on the cable as shown below.

The assembly is completed by either crimping the tube 31.347 and the collar 31.345 on to the cable by means of the special crimping tool, or by soldering the end of the conductor and the tube. Both methods are illustrated below.

Fitting

Drill a hole 13.5 - 14 mm (17/32") at the point selected. Push the free end of the coaxial cable through the hole, and run it between the roof and the headlining to the transmitter/receiver unit.

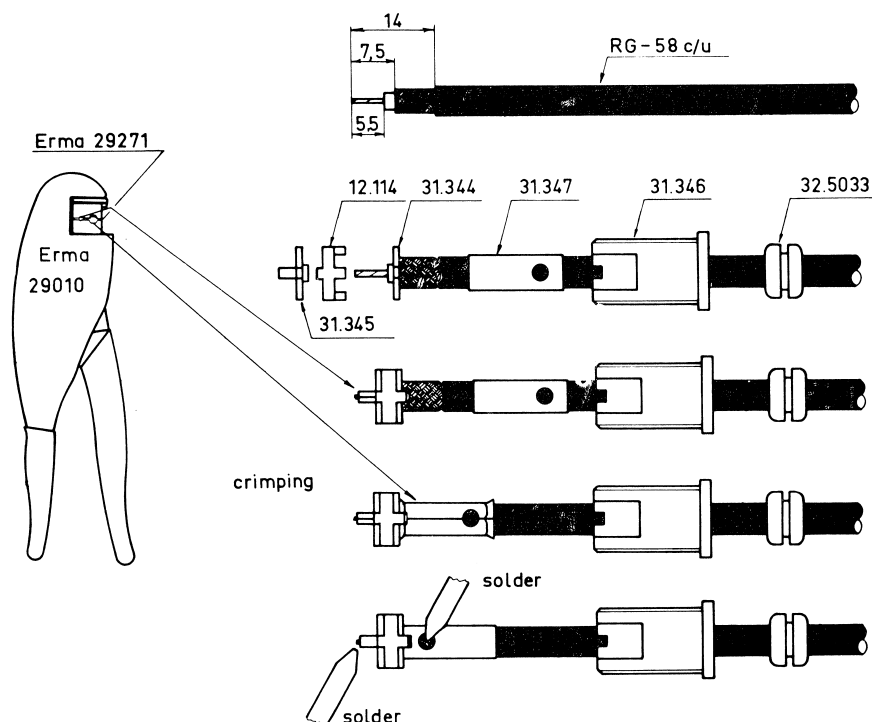
Insert the antenna base half way into the hole as shown in the diagram. Thread the large spiral washer through the hole so that it is under the roof material.

Pull the base back through the hole until the spiral washer is held up against the roof material, add the washer 29.146 and tighten down the nut 29.145.

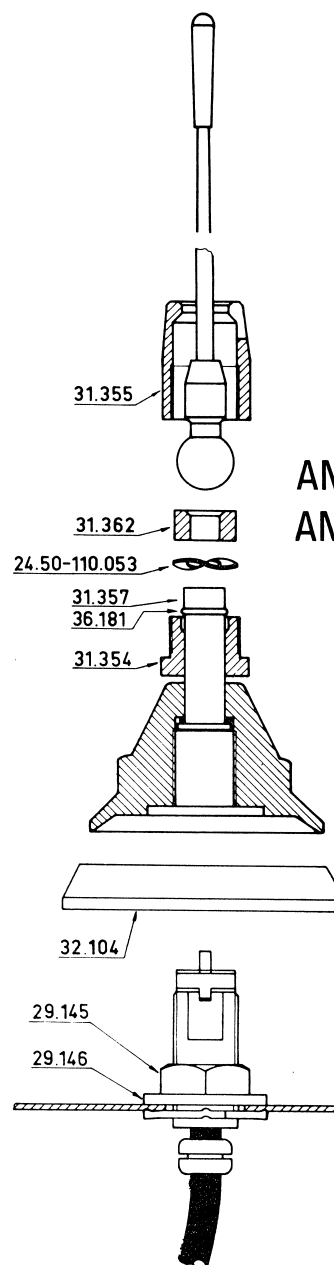
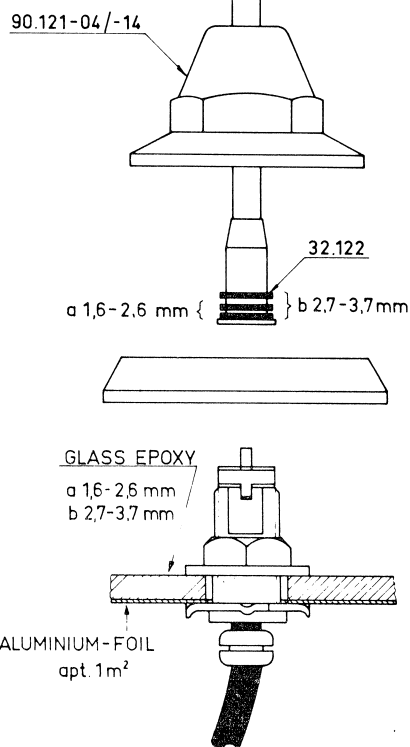
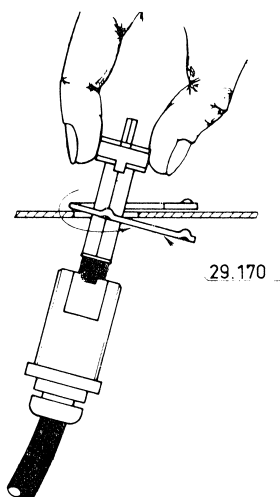
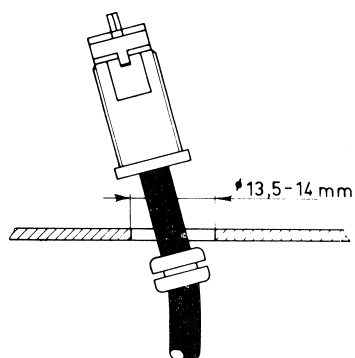
There are two versions of whip section which may be added to the base, the AN69-3 and AN69-4 (UHF) and the AN19-5 and AN39-5 (VHF) which may be folded down. These are attached by placing the sealing washer 32.104 over the base assembly and screwing down the plastic hood 90.121-04/14.

The AN69-3 and AN69-4 is supplied with a number of packing rings which are threaded over the antenna as shown to compensate for the varying roof thicknesses.

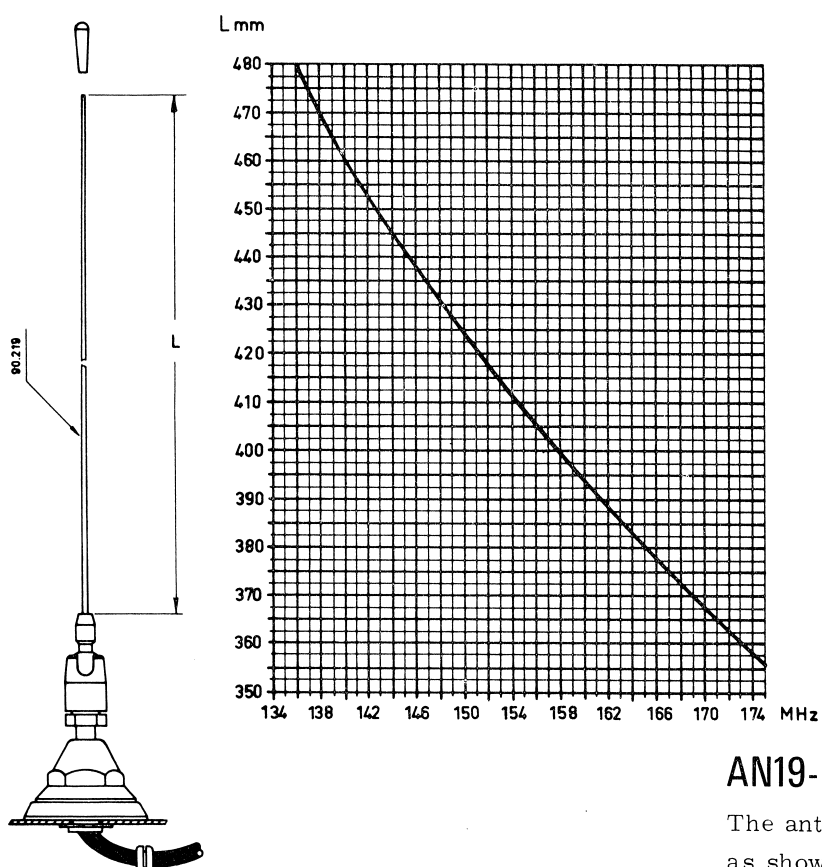
For 1.6 - 2.6 mm. (5/64" - 7/64") two washers are used, whilst for fibre glass which is between 2.7 - 3.7 mm (7/64" - 9/64") three washers should be used.



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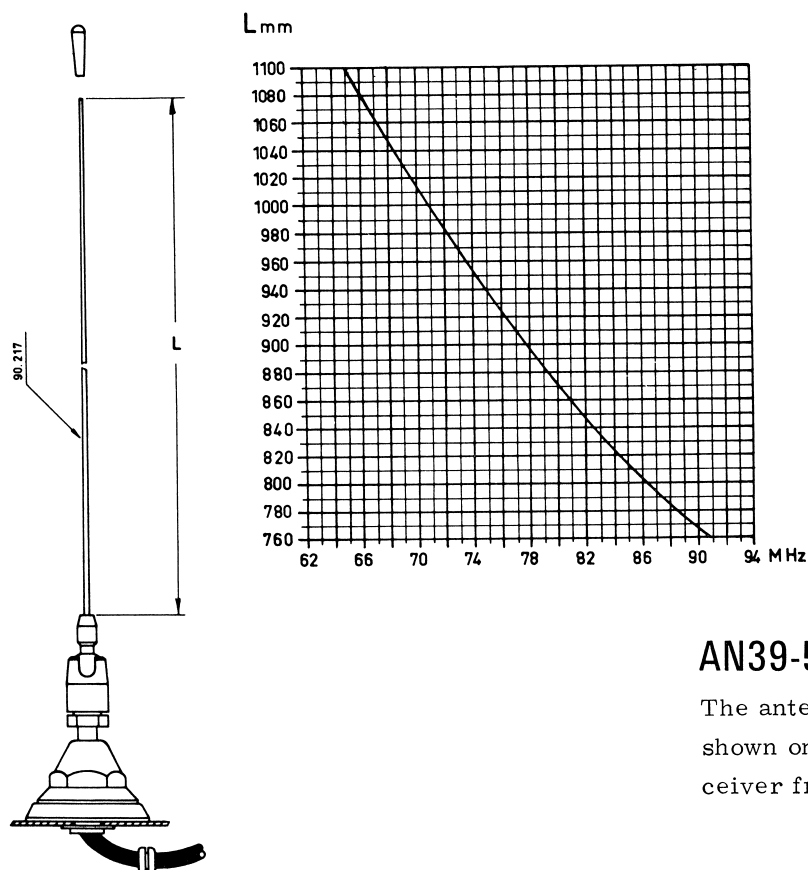
**AN19-5
AN39-5**



AN19-5

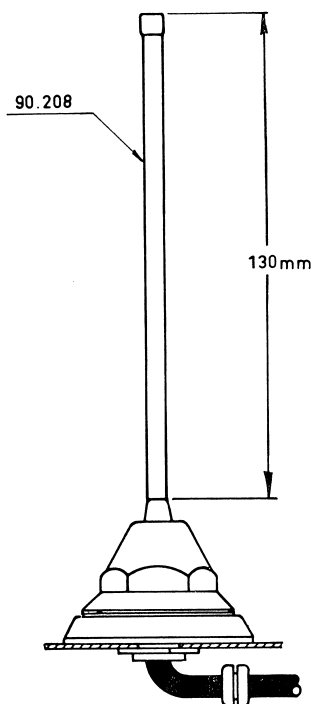
The antenna whip should be cut to frequency as shown on the chart. If the transmitter and receiver frequency differ then the mean is taken.

Chapter IV. Installation



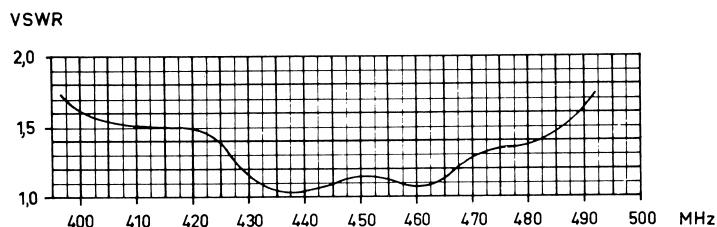
AN39-5

The antenna whip should be cut to frequency as shown on the chart. If the transmitter and receiver frequency differ then the mean is taken.

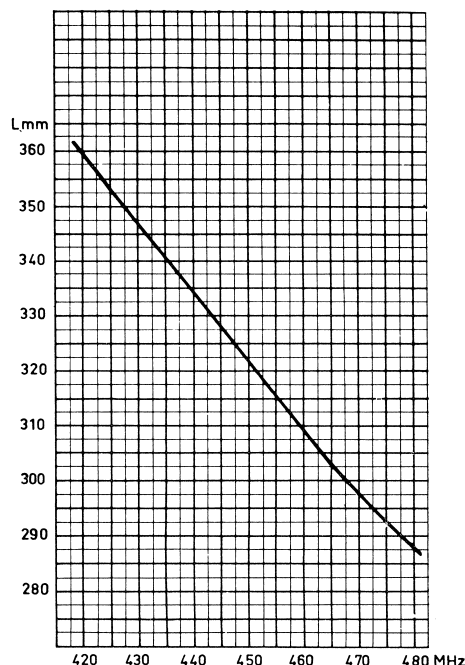
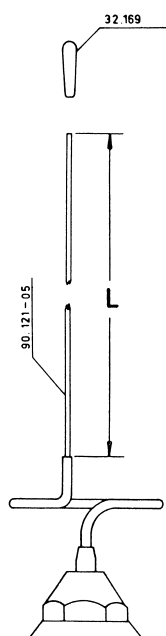


AN69-3

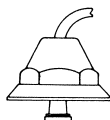
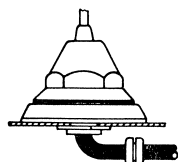
The antenna whip is a fixed $1/4 \lambda$ antenna. The standing wave ratio at various frequencies within the 450 MHz band is shown on the chart.



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**AN69-4**

The antenna whip should be cut to frequency as shown on the chart. If the transmitter and receiver frequency differ then the mean is taken.

**F. Noise Suppression****Introduction**

Noise interference in mobile radio communication can either be caused by the vehicle's or vessel's own electrical system or be generated by external noise sources such as other vehicles, electrical generators, electrical wires, X-ray apparatus, etc.

The external noise cannot be avoided, but care has been taken in the design of the Stornophone 600 to reduce the effect as much as possible. Such noisy periods will normally be of short duration if the vehicle is on the move.

The electrical noise generated by the vehicle's or vessel's own electrical system can often be suppressed sufficiently by simple means.

It should be noted that as long as the radiotelephone equipment is operating close to the base station the noise will normally not be noticed. The noise will only be heard in the loudspeaker, when the equipment moves away from the base station, where the signal into the receiver is somewhat weaker.

Complete noise suppression of an electrical system can be very difficult in certain cases, but normally it is possible to achieve satisfactory results if the simple advice given below is followed. Moreover, it is recommended that the special handbooks about noise suppression published by the manufacturers of electrical automobile accessories (such as Bosch, Lucas, etc.) be studied.

Ignition Noise

The most common noise source is the ignition system of a petrol engine, and this noise is characterized by a regular ticking sound, which is synchronized with the motor speed. In case the vehicle is not noise suppressed from the factory it is necessary to insert suppression resistors in series with each spark plug or replace the spark plugs with spark plugs having built-in resistors. If suppression resistors are used, wire-wound resistors (5 kΩ) are recommended as these types resistors suppress the noise better

Chapter IV. Installation

than the carbon types (10-15 k Ω). Suppression resistors in the spark plug leads must be placed as close as possible to the spark plugs, and the spark gap should be increased by 0.1mm (.004"). Further noise suppression may be obtained by inserting a suppressor resistor in the cable between the ignition coil and the distributor as close to the latter. The best solution is to replace the distributor rotor by a special rotor with a built-in resistor.

If the steps mentioned above does not result in a satisfactory noise suppression, a 0.1 μ F coaxial condenser should be mounted between the primary of the ignition coil and chassis. The condenser should be fitted near the coil with the chassis wire as short as possible.

Finally, it should be borne in mind that dirty or pitted distributor contacts may cause noise similar to ignition noise.

Dynamo Noise

The dynamo noise is characterized by a whine, where the frequency and strength is synchronized with the motor speed. Normally this noise is due to arcing between dirty or worn brushes and the commutator. Cleaning, or possibly, replacement of the carbon brushes will normally remove the noise.

In some cases it may be necessary to insert a filter in the dynamo circuit. A noise suppressor

condensor should be inserted in the lead from the ignition coil (connection to ignition switch) and in the battery lead from the dynamo terminal. Do not remove more insulating material than absolutely necessary in order to minimize the risk of shorting.

Other Noise Sources

Noise from the voltage regulator can be identified by a rasping noise in the loudspeaker. This noise can normally be removed by mounting a coaxial condenser in the dynamo lead, as close as possible to the regulator housing. The other end of the condenser should be connected to chassis.

All electrical instruments and motors may introduce noise into the radiotelephone. The windscreen wiper motor can for example be suppressed by a conventional noise suppression condenser. The different noise sources can be easily detected by switching on and off the suspected noise sources one by one. Other noise sources are the electric clock, the petrol gauge, the oil lamp, etc., and in all cases the noise can be sufficiently suppressed by correct use of condensers.

Tyre static can sometimes produce interference and in such cases a big improvement may be obtained by mounting special shorting springs on each wheel.

G. Testing of Installed Equipment

Before Switching On

When the Stornophone 600 radiotelephone has been installed in accordance with the instructions above, it should be checked for possible installation faults before the equipment is switched on. The following points should be checked:

1. Check that the multi-way connector is strapped according to the voltage to be applied.
2. Check that the fuse holder contains the correct fuse for the voltage to be applied:
 - 16 amps for 6 volts
 - 6 amps for 12 volts
 - 3 amps for 24 volts

3. In cars with negative to chassis check that the fuse is in the positive lead (marked) and that the lead is connected to the positive terminal of the battery. In cars with positive to chassis check that the fuse is in the negative lead and that the lead is connected to the negative terminal of the battery.
4. Check that the antenna is properly made off. Check the insulation.
5. Check that the equipment is set to the correct channel.

The equipment is checked and correctly adjusted before leaving the factory and only one further adjustment of the modulation sensitivity should be made to complete the installation.

Chapter IV. Installation

Switching On

The equipment is switched on by turning the volume control to its centre position. The equipment is ready to receive.

With no incoming signal, the squelch control is advanced so that noise is heard in the loudspeaker. Adjust the control about the cut-off to ensure positive squelch action. The squelch control is set so that the noise just disappears.

Equipment with Selective Calling

If the receiver has been fitted with selective calling equipment, the "loudspeaker in" button should be pressed before carrying out the above check. The green lamp will be lit. Check that the noise disappears when the "loudspeaker out" button is operated, and reappears when the "loudspeaker in" button is pressed again. The squelch control is set as above and the "loudspeaker out" button is pressed.

Transmitter

The transmitter is keyed by pressing the appropriate button or switch, upon which the red keying lamp is lit.

In equipment fitted with a selective tone transmitter, the keying button on the control box must be pressed to transmit the tones.

Test Calls

Test calls are made to the associated base station to ascertain that transmission quality is good and that reception is good. In selective calling systems, the "loudspeaker in" button is pressed to check if the channel is free before the test call is made.

If the channel is free, the tone is transmitted, whereupon the base station should reply, reporting the strength and quality of the signal. The base station is then requested to call the mobile, and the "loudspeaker out" is pressed. On reception of the selective call from the base, the loudspeaker will be switched into circuit and the green lamp will light.

If external calling devices are fitted, these should operate when the call is received. Subsequent messages are passed without use of the selective calling.

Modulation Sensitivity Adjustment

The modulation is adjusted by means of R4 in the control box, so that the speech level is set for correct modulation of the transmitter. This is best achieved by using the voice of the operator who will use the set most.

The adjustment must not be such that the ambient noise is sufficient to fully modulate the transmitter.

If the speech/noise level is too low, then the microphone must be brought closer to the operator. With handsets, and fist microphones, the speech/noise level is sometimes too high thus it will be necessary to reduce the sensitivity.

If the sensitivity is too high, the message will be broken up and if it is too low, the message will be clear but weak. The optimum adjustment is found when shouting into the microphone just causes the message to begin to break up.

CHAPTER V. SERVICE

A. Maintenance

Preventive Service Inspections

When a STORNOPHONE 600 has been properly installed and checked for satisfactory operation it should not thereafter be left to itself until breakdowns begin to occur. Every equipment should be inspected at regular intervals and re-adjusted if necessary. The frequency of such routine inspections will depend on the conditions under which the equipment is operated and on the total number of operating hours, but twelve months is the maximum time that should be permitted to elapse from one preventive service inspection to the next.

Thanks to the application of conservative design principles, the STORNOPHONE 600 may be expected to have long life. Easy service and fault finding were two other important design considerations. All significant currents and voltages are specified in the circuit diagrams. On each circuit diagram is printed a screen picture of the wiring board, showing the diagram symbols of the individual components.

Moreover, all modules have easily accessible test points to permit rapid checking of the operational condition of the equipment. When a module is to be serviced on the bench it is usually a good plan to illuminate the board strongly from behind, which will cause the printed wiring to stand out clearly.

Test Report

Each STORNOPHONE 600 dispatched from the factory is accompanied by a Test Report listing all test-point values for that particular equipment, as measured by the Final Testing Department. These readings vary somewhat from one equipment to the next, so the metering chart will provide a useful standard of comparison during future checks. It is suggested that a sort of "log" be kept of all check measurements made on each individual equipment because a compar-

ison between individual test-point readings over a certain period will make it possible for the service technician to form a clear idea of the general condition of the equipment and will distinctly show when readjustments etc. should be made.

Readings at Test Points

The list below specifies all test points in the equipment and the respective readings. Readings are intended only as a guide.

CQM661, CQM662, and CQM663

POINT	UNIT	INSTR.	MEASUREMENT
1	RC661	Probe A	15-35 μ A
2	RC661	Probe A	15-35 μ A
3	RC661	Probe A	5-25 μ A
4	RC661	Probe A	$\Delta \blacklozenge$ 15-50 mV
5	RC661	Probe A	Δ 30-80 mV
7	IC60x	Probe B	0.2-0.8V
8	IA601	Probe B	\square 1.0-3.0 μ V
10	IA601	AF-voltm.	\blacksquare 20kHz: 0.8-0.9V 25kHz: 0.9-1.1V 50kHz: 1.2-1.4V
14	SQ601	AF-voltm.	\blacksquare 1.1V
27	AA601	AF-voltm.	\blacktriangle 0.5-1.0V
30	EX661	Probe B	0.5-1.4V
32	EX661	Probe B	1.0-1.6V
33	EX661	Probe C	3.0-5.0V
34	EX661	Probe C	2.0-6.5V
35	EX661	Probe B	1.5-2.5V
36	PA661	Probe D	\bigcirc 15-20V
37	PA661	mA-instr.	\times 150-250mA
38	PA661	mA-instr.	\times 500-800mA

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◆ Without oscillatorsignal

△ Antenna signal - EMF for $4\ \mu\text{A}$

□ Antenna signal - EMF for 1V

■ Antenna signal $1\ \mu\text{V}$ EMF, $0.7 \times \Delta F$ max 1000Hz.

▲ Frequency deviation $0.7 \times \Delta F$ max. and 1000Hz.

○ Measured across a $47\ \Omega$ resistor

* Measured at nominal output power.

Probe A: Probe + 0-50 μA instrument ($R_i=1\text{k}\Omega$)

Probe B: Probe + 0-2.5V instrument (20 $\text{k}\Omega/\text{V}$)

Probe C: Probe + 0-10V instrument (20 $\text{k}\Omega/\text{V}$)

Probe D: Probe + 0-25V instrument (20 $\text{k}\Omega/\text{V}$)

Test Points

Most modules have two kinds of test points - DC test points, which are designated by numbers in circles (1); and signal test points, designated by numbers in squares, [2]. Measurements at DC test points should be made with a multimeter having an internal resistance of at least 20 $\text{k}\Omega/\text{V}$. RF signal measurements may be made with a multimeter in conjunction with a STORNO Type 95.089 RF probe. Audio-frequency signal measurements require the use of a vacuum-tube voltmeter.

Routine Inspections

A normal routine inspection should cover checks of all test points in the equipment, and the readings taken should thereafter be checked against

readings obtained in previous routine inspections. However, each routine inspection should also comprise the operations specified below:

- 1) Inspect (visually) transistors, diodes etc. Fasten any components that may have worked loose.
- 2) Check the supply voltage. It should not be outside these values: $6.3\text{V} \pm 20\%$, $12.6\text{V} \pm 20\%$, and $25.2\text{V} \pm 20\%$.
- 3) Check cable connections, fuse box, battery (look for corroded joints; top up with distilled water if necessary). Also check the current drain.
- 4) Measure the carrier power delivered by the transmitter. Readjust the ADC-circuit if necessary.
- 5) Measure the receiver sensitivity and readjust the receiver input circuits if necessary.
- 6) Call the base station and perform speech test.
- 7) Check the antenna mounting, especially for rust.

Replacement of Modules

In certain situations time can be saved by replacing a probably defective module with a new module of the same type.

Even if it is known to be fully aligned, such a newly inserted module may require a few minor readjustments.

B. Fault-finding and Repairs

Fault-finding

Fault-finding should be performed only by skilled personnel who have the necessary measuring instruments etc. at their disposal and have previously studied the operating principles of the STORNOPHONE 600.

Before starting work, find out whether the fault is located in the accessories, in the outside power source, in the installation cabling, or in the transmitter/receiver equipment itself.

Keep in mind when making check measurements and adjustments that the STORNOPHONE 600 has a number of adjustments that should not be touched unless the necessary measuring in-

struments are available. In any case it is important that the directions given in Sec. C (Adjustment Procedure) be followed closely in each individual case if a satisfactory result is to be obtained.

Resistance Measurement

Two precautionary measures are necessary when making resistance measurements on transistor circuits. Firstly, it is necessary to make sure that the ohmmeter current does not exceed one milliamperere, which may very well be the case with certain types of vacuum-tube voltmeters. Secondly, the ohmmeter volt-

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age may cause the transistors to become conductive, with incorrect readings as the obvious result. Since most faults are either short circuits or open circuits, accurate measurements of resistance are not normally required.

Soldering on Semiconductors

Never forget, when soldering on semiconductors, that the soldering operation should be performed quickly and as a general rule it is not advisable to solder closer to semiconductors than approx. 5mm - germanium transistors, for instance, will not stand temperatures above 85-90°C.

However, a transistor should not be replaced until it has been determined with reasonable certainty that it is defective. Even transistors of the same type and make may show fairly wide variations in their data. For this reason it is usually necessary, in the case of replacements, to check the transistor circuits and re-adjust them if necessary.

Wiring Boards

The wiring boards used in the STORNOPHONE 600 are very rugged, but in unfortunate cases it is possible for the printed wiring to break or detach itself from the board. This usually happens when excessive heat is applied when soldering or when a soldering operation lasts longer than it should. Fine cracks in the wiring or in the wiring board itself are mostly diffi-

cult to spot with the naked eye, in which cases a magnifying glass will be a good help. This type of fault can also be the cause of trouble of an intermittent nature.

Such faults are easily corrected by soldering a short end of wire across the broken place on the board. The wiring boards also carry some fixed capacitances. Here, repairs must be made with some caution in order to avoid changes in capacitance.

Replacement of components

Replacement of resistors, capacitors and similar components on printed wiring boards require the use of a small pencil-type soldering iron of 30- to 75-watt rating so as to permit rapid soldering. The use of a tin sucker to drain away melted solder is also advisable. Do not attempt to pull any component off the wiring board until the solder flows smoothly as there is otherwise a risk of pulling some of the printed wiring off the board. As a general rule the soldering iron should not be applied to the board for a longer time than strictly necessary. Care should be taken, when soldering a new component to the wiring board, that no short circuits are caused by excess solder. Do not use more solder than strictly necessary. Large blobs of solder can reduce the spacing between the printed wires, which can produce undesirable effects in RF circuits even if no actual short circuit exists.

C. Adjustment Procedure

GENERAL

The directions given in this section are intended as an aid in aligning a STORNOPHONE 600 and consequently must not be considered the only correct adjustment procedure. However, departures from the directions given here should be made only in cases where the technician can foresee with certainty that modified alignment methods will neither degrade the specifications stipulated nor complicate subsequent alignment procedures.

Only such skilled radio technicians as have already acquainted themselves with the operation of the STORNOPHONE 600 should perform adjustments and repairs.

Each individual radiotelephone is checked and tested before being dispatched from STORNO. In the absence of any special agreement, the Testing Department has:

- 1) Inserted oscillator units with quartz crystals for the channels ordered.
- 2) Aligned the complete radiotelephone so that the accuracy of the transmitting and receiving frequencies is better than 1×10^{-6} in CQM661 and better than 0.5×10^{-6} in CQM662 and CQM663.
- 3) Adjusted the receiver audio output and the speech limiter clipping level according to specifications.

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- 4) Adjusted and tested the built-in tone equipment (if provided).

When the installation has been completed and its proper execution checked, the transmitter modulation sensitivity should be adjusted. (R4 in CB60x).

CAUTION: The greatest care should be shown when measuring currents, voltages etc. in the circuits of the STORNOPHONE 600 as even brief short circuits, such as may be caused by the test prods of a measuring instrument, may in certain cases cause permanent damage to a transistor.

STORNOPHONE 600

This adjustment procedure applies to the following radiotelephones:

CQM661 (420-470MHz), 50 kHz channel separation
CQM662 (420-470MHz), 25 kHz channel separation
CQM663 (420-470MHz), 20 kHz channel separation

Directions for adjusting the TR68x tone receiver and the TT68x tone transmitter are also given.

Measuring Equipment

While adjustments are being performed, the STORNOPHONE 600 should be connected to a control box and a power supply unit via a standard installation cable with fuse holder and fuse mounted in place.

The power supply should be adjusted to deliver the voltage for which the voltage switch and con-

ductor straps of the equipment have been set. Voltages should be as follows:

For 6-volt operation: 6.3 volts (as measured at input terminals of power supply unit PS601).

Got 12-volt operation: 12.6 volts (as measured at input terminals of power supply unit PS601).

The following instruments are required:

A power supply rated at 5.0 - 33 V/15 A.

A signal generator, for 420-470 MHz.

A crystal-controlled signal generator for 455 kHz (e. g. STORNO-sweepgenerator type L20).

An audio voltmeter.

A distortion meter.

A standard receiver with calibrated discriminator.

A wattmeter, 0-10 watts/0-25 watts.

A dummy load.

A tone generator.

An RF probe (STORNO Type 95.089).

An antenna filter unit (Storno type FN611).

A signal coupling network Storno type 95.155).

A multimeter, 20 k ohms per volt.

A microammeter, 50-0-50 μ A, $R_i = 1000$ ohms.

A milliammeter, 0 - 500 milliamps.

An ammeter, 0 - 1 amp.

With these instruments available, the STORNOPHONE 600 can always be restored to operating condition.

RECEIVER ALIGNMENT

Before starting alignment of the receiver, first check the internal supply voltage, -24 volts. If necessary, adjust it for the correct value, using potentiometer R14 in power supply unit PS601.

Also check that the straps in receiver converter

RC661, intermediate-frequency amplifier IA601 and squelch and audio amplifier SQ601 are in accordance with the channel separation in use (see circuit diagrams of the respective units).

Alignment of Low IF Channel and Discriminator, IC60x and IA601

Apply a 455 kHz signal (approx. 3 μ V) to the input of BP60x without cutting off the connection between IC60x and BP60x.

Connect RF probe and multimeter at test point 9.

Adjust coils L1, L2, and L3 in IA601 for maximum meter reading, approx. 6 μ A.

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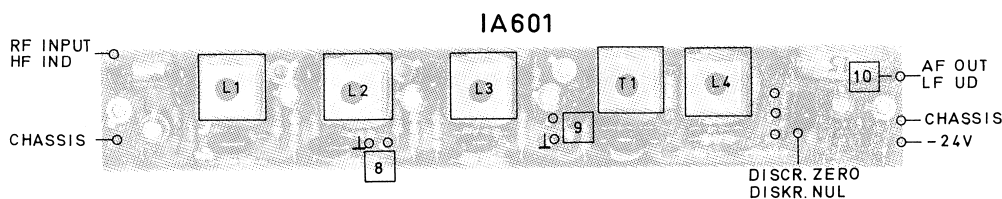


Fig. 1

Apply a 455 kHz signal (approx. 1mV) to the input of IA601 without cutting off the connection between BP60x and IA601.

Connect 50-0-50 microammeter to tap marked "Discriminator Zero".

Adjust coil L4 (discriminator secondary) for zero reading on 50-0-50 microammeter.

Adjust transformer coil T1 (discriminator primary) for best symmetry at 455 kHz \pm 15 kHz.

Since these two circuits interact, the discriminator zero must be constantly checked and readjusted.

Reading for \pm 15 kHz at 1 mV input signal: 37.5 μ A \pm 2 μ A.

Linearity at \pm 15 kHz: 2.5 μ A per kHz.

Low-IF block filter BP60x is aligned and artificially aged at the factory, making subsequent realignment unnecessary.

Alignment of Signal Frequency Amplifier and High IF Channel, XO611 and RC661

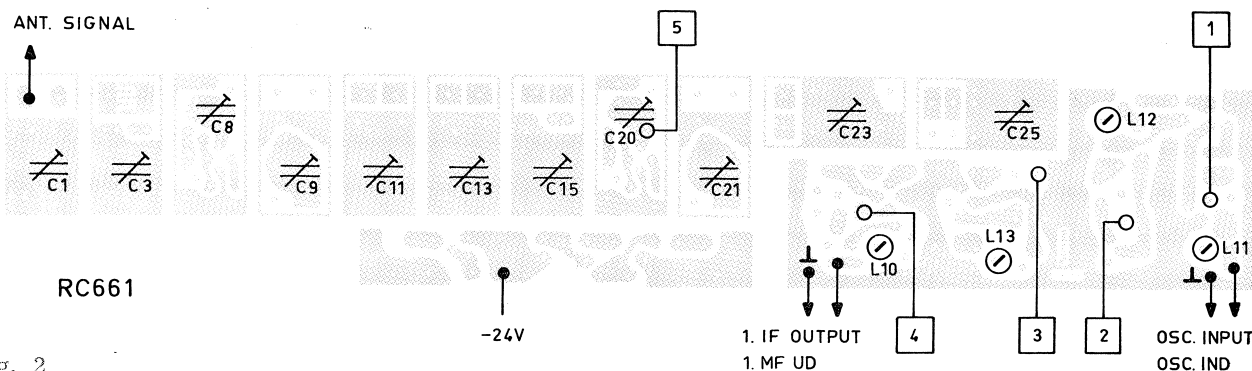


Fig. 2

Calculation of the crystal frequency (fx) for a given signal frequency (fsig):

$$f_x = \frac{f_{sig} - 10.7}{9} \text{ MHz.}$$

XO611

Connect RF probe and multimeter at testpoint **1** in RC661.

Adjust coil L1 in the used oscillator unit XO611 for maximum meter reading (see values on the Test report).

RC661

Connect RF probe and multimeter at testpoint **1**.

Adjust coil L11 in RC661 for maximum meter reading (see values on the Test report).

Connect RF probe and multimeter at testpoint **2**.

Adjust coil L12 in RC661 for maximum meter reading (see values on the Test report).

Connect RF probe and multimeter at testpoint **3**.

Adjust coil L13 in RC661 for maximum meter reading (see values on the Test report).

Connect RF probe and multimeter at testpoint **4**.

Adjust capacitor C25 in RC661 for maximum meter reading, 15 - 45 μ A.

Set the neutrodyne capacitors C8 and C20 for minimum capacity (their tuning slugs fully turned out).

Connect the signal generator via a signal coupling network, Sorno type 95.155, at testpoint **5** and set it to the signal frequency.

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Connect the RF probe and the multimeter at testpoint **8** in IA601.

Adjust capacitors C15, C21, C23, and coil L10 in RC661 and coil L1 in IC60x for maximum meter reading.

Adjust capacitor C13 in RC661 for minimum meter reading.

Adjust capacitor C11 in RC661 for maximum meter reading.

Adjust capacitor C9 in RC661 for minimum meter reading.

Connect the signal generator to the antenna input and set it to the signal frequency.

Adjust capacitors C1, C3, C9, C11, C13, and C15 in RC661 for maximum meter reading.

Set the output of the signal generator for a level corresponding to a meter reading of approx. $10\ \mu\text{A}$ at testpoint **8** in IA601.

Reduce the output from the signal generator by 6 dB and increase the capacity of C20 by a quarter of a turn at a time (at the beginning, however, a little more) at the same time re-adjusting the adjacent circuits until a reference of $10\ \mu\text{A}$ at testpoint **8** is obtained.

Adjust neutrodyne capacitor C8 in exactly the same way.

Adjustment of Oscillator X0611

The oscillator unit is adjusted before leaving the factory for which reason frequency adjustment is necessary only when a new crystal has been inserted. However, if a frequency counter is available, the oscillator can be adjusted by means of trimmer capacitor C4 in the unit, with the frequency counter connected at testpoint **2** in RC661 via a capacitor.

Requirements

In CQM661 the accuracy of the oscillator frequency should be better than 1×10^{-6} .

In CQM662 and CQM663 the accuracy of the oscillator frequency should be better than 0.5×10^{-6} .

Checking the Oscillator in IC60x

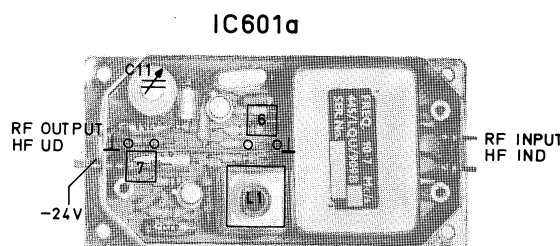


Fig. 3

To adjust the oscillator frequency, connect a frequency counter at test point **7** and, using trimmer capacitor C11, adjust the oscillator to exact frequency (11.155 MHz or 10.245 MHz).

Filter Matching, Audio Level Adjustment, and Sensitivity, IC60x, IA601, and SQ601

Connect the signal generator to the antenna input of RC661, and set it to the signal frequency.

Connect RF probe and multimeter at testpoint **8**.

Readjust the coils L10 in RC661 and L1 in IC60x for maximum amplification. The signal from the

generator should be the lowest possible, approx. $2\ \mu\text{V}$ E. M. F.

Set the frequency swing of the signal generator to 70% of the maximum permissible limit:

- 2.8 kHz for 20 kHz channel separation
- 3.5 kHz for 25 kHz channel separation
- 10.5 kHz for 50 kHz channel separation

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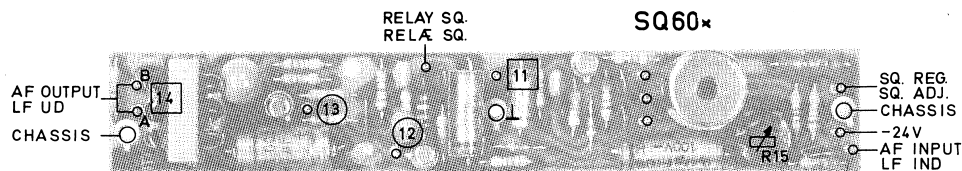


Fig. 4

The modulating frequency should be 1000 Hz.
The RF level should be 1 mV.

Connect the distortionmeter and the audio voltmeter at test point **14** in SQ601 (at output terminals) or the terminals A and E in the control box.

Adjust, by means of potentiometer R15 in SQ601, the output level for 3 dBm, corresponding to 1.1V across a 600-ohm load.
Distortion less than 5%.

NOTE: The 600-ohm load is located in the control box, where it serves as level control.

Switch to the receiving channel using the highest frequency.

Connect the distortionmeter and the audio voltmeter at testpoint **10** in IA601.

Set the signal generator to the signal frequency selected, still keeping the frequency swing at 70% of the maximum permissible limit and the modulating frequency at 1000 Hz.

Adjust the signal generator output for 1 mV.

Calibrate the distortionmeter so that the sum of signal, noise, and distortion corresponds to 100% when the filter is not inserted.

Insert the filter to remove the modulating frequency.

Reduce the output of the signal generator until the distortion meter reading increases to 25%, corresponding to a 12 dB ratio between signal +noise+distortion (12 dB SINAD).

Readjust the input filter L1 and L2 in RC661 for the best possible signal-to-noise ratio. It should be possible to obtain a 12 dB signal-to-noise ratio for 0.8 μ V E. M. F.

In case the sensitivity is too poor adjust the neutrodyne capacitors C8 and C20 in RC661 for highest amplification. This increase in amplification, however, must not exceed 3 dB per amplifier stage (Q1 and Q2). (See the last section of paragraph "Alignment of Signal Frequency Amplifier and High IF Channel, XO611 and RC661").

If the sensitivity is better than 0.8 μ V E. M. F. keep the setting of C8 and C20 in RC661 and thus the 6 dB amplification per stage, for which adjustment has been made formerly.

When the alignment of all RF circuits is finished check the stability with open antenna input by tuning the coils L3 and L7 in RC661 round the resonance point. In case of unstableness the capacity of the neutrodyne capacitors has become too high, and consequently their capacity should be reduced until stability occurs.

Squelch Sensitivity

Keep the signal generator connected to the antenna input of RC661 and keep it set at the signal frequency. Set the frequency swing to 70% of the maximum permissible limit. The modulating frequency should be 1000 Hz.

Check that the squelch control is working, that is, it must be capable of cutting in the receiver out-

put and turning it off again in the absence of an incoming RF signal.

The squelch control is located in the control box.

Set the squelch control to the threshold value (in the absence of an incoming RF signal). Again apply an RF signal and increase it until the squelch circuit opens the signal path through the receiver.

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Minimum signal-to-noise ratio in the speech channel: 6 dB SINAD.

"Tight up" the squelch control and increase the

RF signal level until the squelch circuit opens the signal path.

Maximum signal-to-noise ratio in the speech channel: 21 dB SINAD.

TRANSMITTER ALIGNMENT

Check that the straps in units EX661, PA661 and AA601 are in accordance with the channel separation in use and the frequency band in use (see circuit diagrams).

Transfer the signal lead connecting exciter EX661 to power amplifier PA661 to the 47-ohm load resistor in PA661, test point (36) which loads the exciter during adjustments.

The transmitter must operate under carrier-on conditions during the subsequent adjustments. This is accomplished by depressing the transmit button or by connecting terminals V and K-L together.

Set the ADC control potentiometer (R5 in PA661) at mid-scale.

Alignment of Exciter EX661

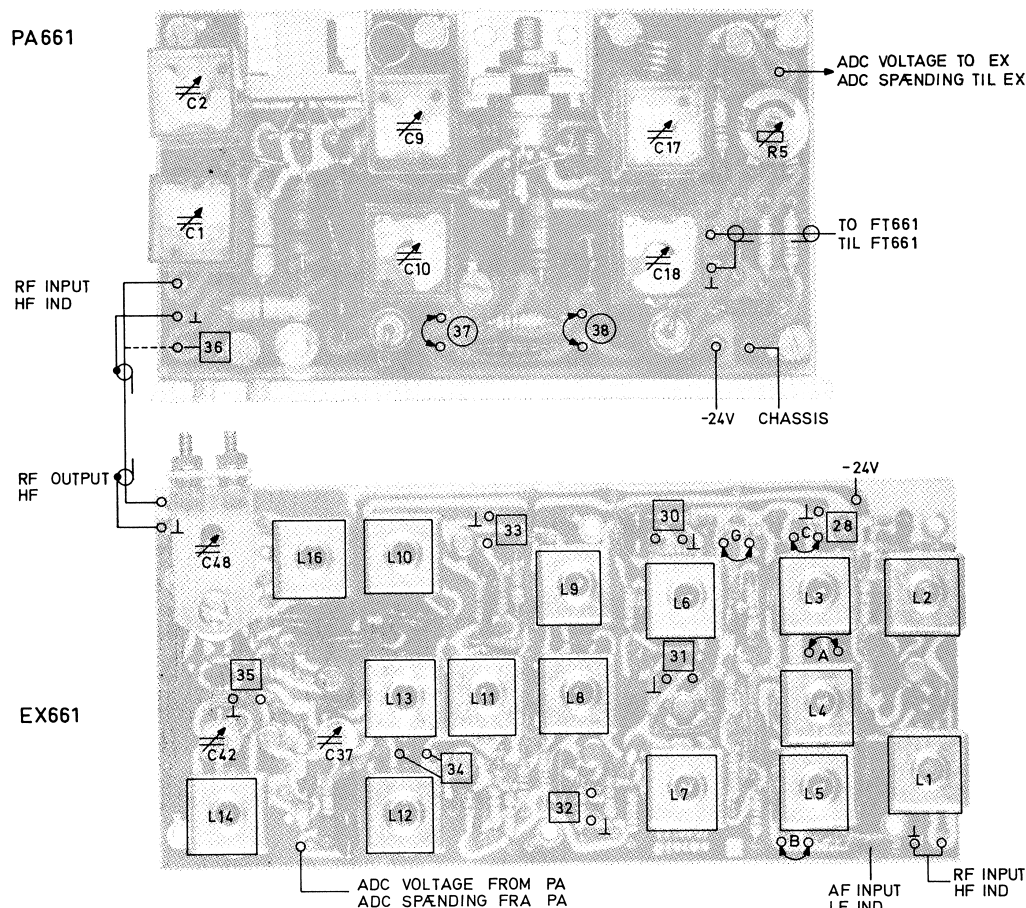


Fig. 5

Alignment of the exciter should be performed without modulating signal from AA601.

Connect RF probe and multimeter at test point (30).

Adjust coils L1, L2, and L6 for maximum meter reading, approx. 0.5V.

Insert straps marked G and A.

Adjust coil L3 for maximum meter reading, approx. 0.5V.

Insert straps marked G and B instead.

Adjust coil L4 for minimum reading, approx. 0.05V.

Insert straps marked G and C instead.

Adjust coil L5 for minimum meter reading, approx. 0.05V.

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Repeat alignment of coils L3, L4, and L5 (this is necessary because of interaction between the circuits) until minima and maxima are obtained.

Remove straps.

Readjust coils L2 and L6 for maximum meter reading, approx. 0.5V.

Connect RF probe and multimeter at test point 32.

Adjust coil L7 for maximum meter reading, approx. 1.0V.

Connect RF probe and multimeter at test point 33.

Adjust coils L8 and L9 for maximum meter reading. Repeat the adjustment of these coils several times. Reading: approx. 4.0V.

Connect RF probe and multimeter at test point 34.

Adjust coils L10 and L11 for maximum meter reading, approx. 4.0V.

Connect RF probe and multimeter at test point 35.

Adjust coils L12 and L13 as well as trimmer capacitor C37 for maximum meter reading, approx. 2.0V.

Connect RF probe and multimeter at test point 36 in PA661 (across 47-ohm load resistor R8).

Adjust coils L14 and L16 as well as trimmer capacitors C42 and C48 for maximum meter reading, approx. 18V.

Adjustment of Power Amplifier Stage, PA661

First the signal lead from the exciter should be transferred from the load resistor to the input of PA661.

Connect a wattmeter and an antenna filter unit, Storno type FN611, across the input of PA661 instead of frequency tripler FT661.

Remove strap designated 37 and replace it with a 500-mA meter.

Remove strap designated 38 and replace it with a 1-amp meter.

Back off the ADC potentiometer, R5 (anti-clockwise).

Depress the transmit button (or strap terminals V and K-L together).

Carefully advance the ADC potentiometer, adjust-

ing trimmer capacitors C1, C2, C9, C10, C17, and C18 for maximum power output.

When maximum power output has been obtained with the ADC potentiometer at maximum and the entire stage completely adjusted, reduce the output to 11 watts using the ADC potentiometer.

Readjust trimmer capacitors C17 and C18 for maximum power output.

Again adjust the ADC potentiometer for 11 watts power output.

At 11 watts output and during the alignment the current at test point 37, as measured with the milliammeter, should be less than 250 mA, and the current at test point 38, as measured with the 1-amp. meter, should be less than 800 mA.

Adjustment of Frequency Tripler FT661

Connect the frequency tripler unit to the output of the power amplifier unit PA661.

Back off the ADC potentiometer (anti-clockwise).

Connect a wattmeter across the output of the transmitter using a short cable.

Depress the transmit button (or strap terminals V and K-L together).

During the following coarse adjustment of the frequency tripler the RF probe is used in conjunc-

tion with a multimeter by short-circuiting the input of the probe, thus making it form a small coupling loop.

Carefully advance the ADC potentiometer a little and couple the RF probe loosely to coil L1 in FT661.

Adjust trimmer capacitors C2 and C3 in FT661 for maximum meter reading.

Couple the RF probe loosely to coil L4 in FT661.

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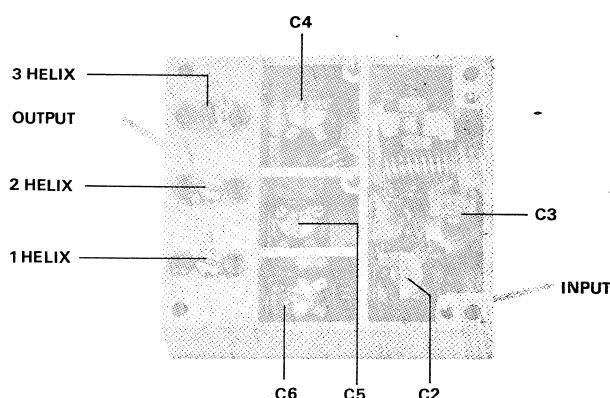


Fig. 6

Adjust trimmer capacitors C4, C5, and C6 for maximum meter reading.

Adjust 1st helix circuit for minimum meter reading.

Adjust 2nd helix circuit for maximum meter reading.

Adjust 3rd helix circuit for minimum meter reading.

The deflection on the wattmeter should then be very small.

Readjust all the trimmer capacitors and the helix

circuits in FT661 for maximum power output, at the same time adjusting the ADC potentiometer until the currents at test points (37) and (38) correspond to those measured during the preceding adjustments of the power amplifier unit PA661 at 11 watts power output.

Set the ADC potentiometer for 6 watts power output.

Readjust the trimmer capacitors C17 and C18 in PA661 for maximum usefull effect (minimum currents at test points (37) and (38)).

Crystal Oscillator X0631

Crystal oscillators are as a general rule adjusted before leaving the factory, for which reason frequency adjustment is necessary only when a new crystal has been inserted.

A frequency counter is required for making the exact adjustment.

In this case the transmitter should be aligned first, because the frequency is most easily measured at the transmitter output.

Requirements

In CQM661: The frequency accuracy should be better than 1×10^{-6} .

In CQM662 and CQM663:

The frequency accuracy should be better than 0.5×10^{-6} .

Modulation Adjustment, AA601

Make sure that the unit is strapped for phase modulation (see circuit diagram).

Set potentiometer R28 at mid-scale.

Connect standard receiver and distortion meter

to the transmitter output through attenuating networks.

Connect audio voltmeter and tone generator to terminals B and F in the control box (modulation input of the transmitter).

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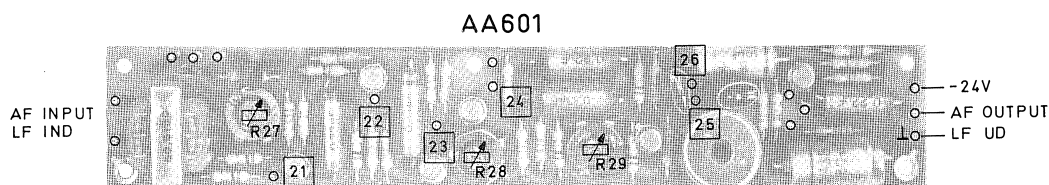


Fig. 7

Adjust the input signal from the tone generator for modulation level, 110 mV + 20 dB, corresponding to 1.1 V.

Vary the frequency between 300 and 3000 c/s while adjusting for maximum frequency swing.

CQM661: ΔF max = 15 kHz.

CQM662: ΔF max = 5 kHz.

CQM663: ΔF max = 4 kHz.

Adjust, by means of potentiometer R29 in AA601, the frequency swing so that it will not exceed the maximum value (ΔF max.) anywhere inside the frequency range 300 - 3000 Hz. This should be checked at both negative and positive modulation peaks.

Using potentiometer R27, adjust the modulation sensitivity so that a 110 mV input voltage at

1000 Hz from the tone generator produces a frequency swing that is 70% of the maximum permissible swing.

Repeat the adjustment of potentiometers R29 and R27.

Adjust, at the 110 mV (1000 Hz) input voltage, the symmetry of the limiter for minimum distortion, using potentiometer R28.

Recheck the modulation sensitivity and readjust it if it has changed.

Read the distortion meter. Distortion should be less than 8%.

NOTICE! Distortion should be measured with de-emphasis.

UNITS IN CONTROL BOX

Checking the AA602 Audio Output Amplifier

Connect the signal generator to the antenna input of the receiver and set it to the signal frequency at a frequency swing that is 70% of the maximum permissible swing at 1000 Hz.

Connect a 15-ohm 3-watt load resistor across the output terminals of the AA602 output ampli-

fier. Also connect an audio voltmeter across the same terminals.

Turn the volume control of the control box fully open. The voltage across the load should be at least 6.3V.

Tone Receiver TR68x

This unit is adjusted before leaving the factory and requires no subsequent readjustment.

Tone Transmitter TT68x

Connect an audio voltmeter to the output of the tone transmitter and connect a standard receiver to the antenna output of the transmitter section.

Adjust the coil of the tone transmitter for a tone frequency of 1060 Hz.

Apply power to the tone transmitter.

Adjust, by means of the alignment potentiometer of the tone transmitter unit, the tone transmitter output level for 110 mV, corresponding to a measuring level of -17 dB.

If a two-tone transmitter is used, each transmitter section should deliver only half the voltage specified above. This is performed by short-

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circuiting one of the tone-coils and thus cut out one of the oscillators. Then adjust the output level for 55 mV.

Check the frequency swing at 1060 Hz.

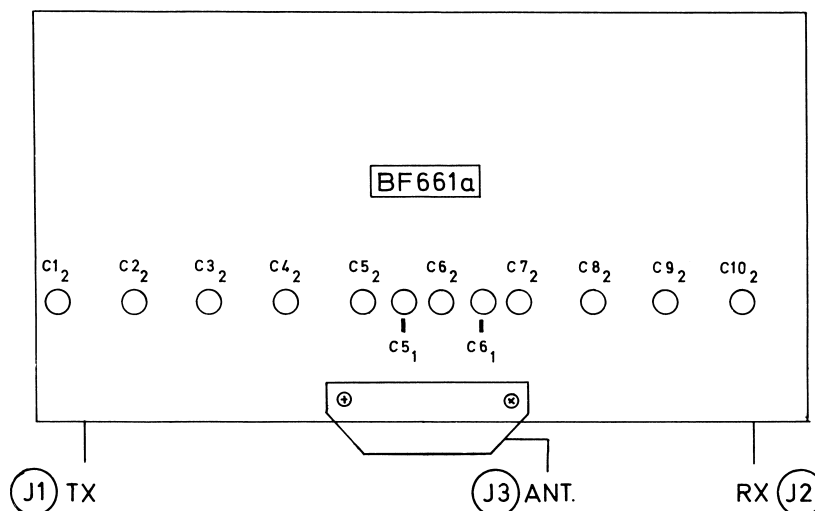
Adjust the tone transmitter coil for the desired

tone frequency. Recheck the frequency swing.

Frequency swing for single-tone transmitter: 70% +1, -2 dB of maximum frequency swing.

Frequency swing for two-tone transmitter: 35% for each tone.

Adjustment of Antenna Branching Filter BF662



Switch the radio station to a channel in the centre of its channel coverage range.

Set the trimmer capacitors C5₁, C5₂, C6₁, and C6₂ at minimum capacitance.

Adjustment of the Transmitter Section for Isolation of the Receiving Frequency

Connect a 50 ohms signal generator, set to the receiving frequency, to J3.

Connect the receiver to J1.

Connect a 50-ohm load to J2.

Adjust the trimmer capacitors C1₂, C2₂, C3₂, C4₂, and C5₂ for minimum signal at the receiver input.

Adjustment of the Receiver Section for Isolation of the Transmitting Frequency

Connect a 50-ohms wattmeter to J3.

Connect the transmitter to J1.

Connect a 50-ohms standard receiver, set to the transmitting frequency, to J2.

Turn on the transmitter.

Adjust the trimmer capacitors C6₂, C7₂, C8₂, C9₂, and C10₂ for minimum signal to the receiver.

Adjustment of the Transmitter Section for Minimum Attenuation of the Transmitting Frequency

Connect a 50-ohms wattmeter to J3.

Connect the transmitter to J1.

Connect a 50-ohms load to J2.

Turn on the transmitter.

Increase the coupling to L6 by means of trimmer capacitor C6₁. At the same time readjust C6₂ for resonance until minimum insertion loss is obtained. Insertion loss after the first adjustment: approx. 2.5 dB.

Adjustment of the Receiver Section for Minimum Attenuation of the Receiving Frequency

Connect a 50-ohms signal generator, set to the receiving frequency, to J3.

Connect the receiver to J2.

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Connect a 50-ohms load to J1.

Increase the coupling to L5 by means of trimmer capacitor $C5_1$. At the same time readjust $C5_2$ for resonance until minimum insertion loss is obtained.

Insertion loss after the first adjustment: approx. 2.5 dB.

Repeat The adjustments of the transmitter and receiver sections including adjustments for minimum insertion losses.

Insertion losses after this adjustment: approx. 2 dB.

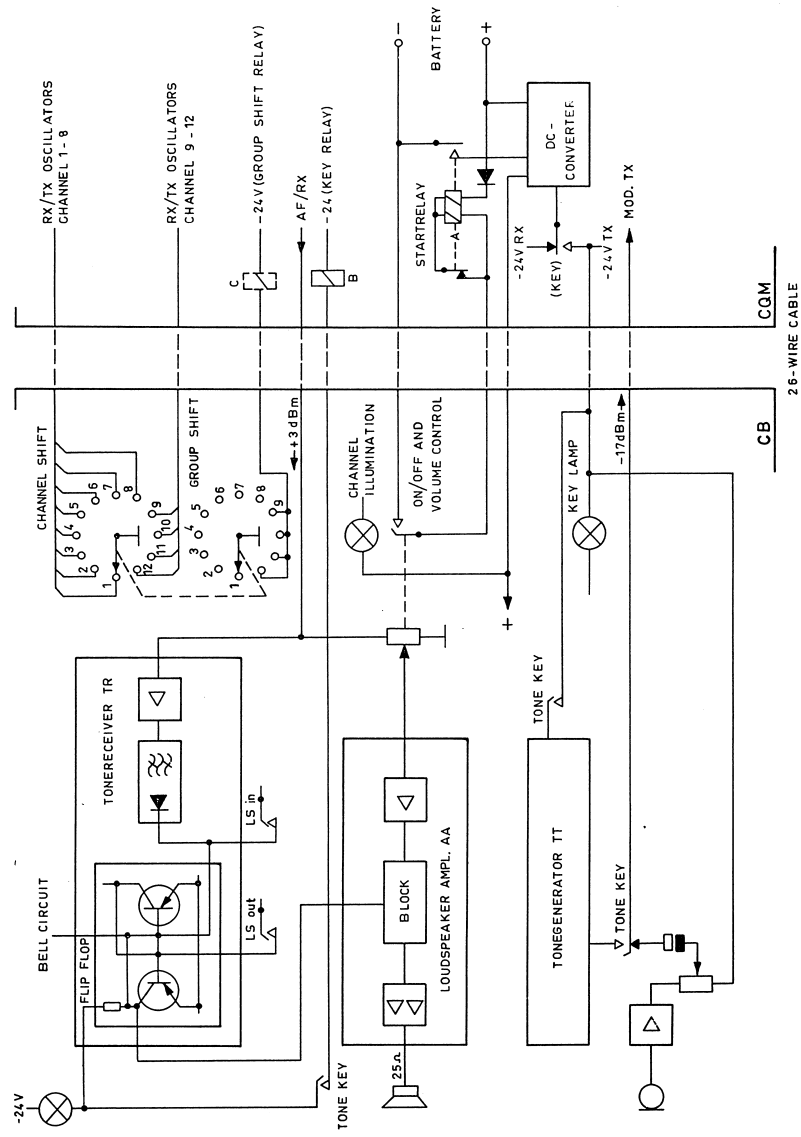
In case the couplings of the filter ($C5_1$ and $C6_1$) are increased too much, the necessary isolations cannot be obtained.

When the adjustments of the filter are completed, the transmitter output stage should be adjusted for maximum power output, and the input stage of the receiver should be adjusted for maximum sensitivity.

CHAPTER VI. DIAGRAMS AND PARTS LISTS

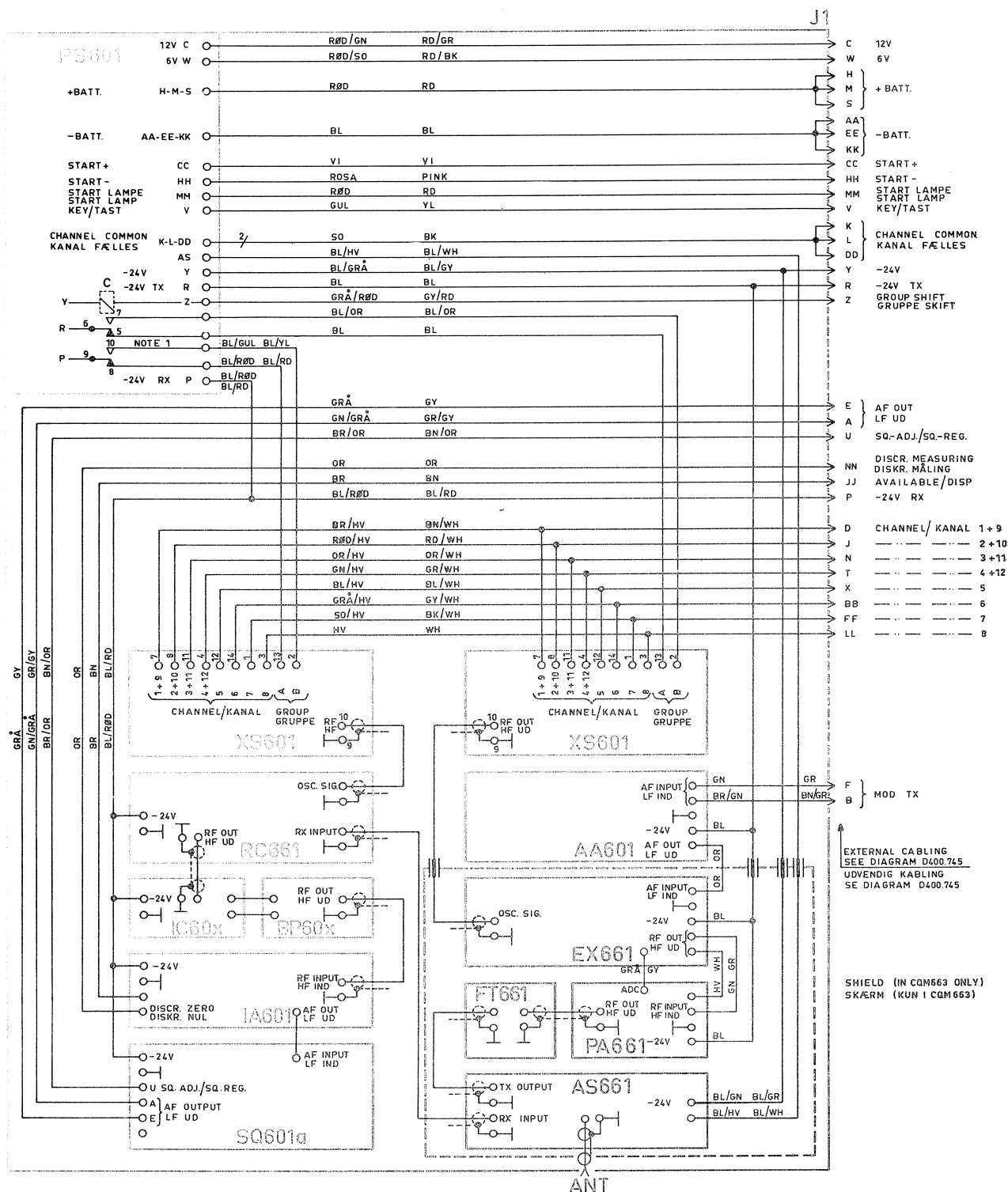
The diagrams and schematics of the radiotelephone station STORNOPHONE 600 are to be found on the pages following. The component designation in each modular unit starts at R1, C1, L1 etc., for what reason special care should be devoted in filling out the spare part order form. All information concerning each component in question can be found in the parts lists and should be stated together with the type designation of the modular unit.

Furthermore - specification of equipment type and possible production number will ease the handling of the order at Storno and minimize the risk of erroneous delivery. The last page in this manual contains alterations and modifications of the equipment.



FUNCTION DIAGRAM CQM600
FUNKTIONSDIAGRAM

D400.673



NOTE 1. Relay C is only inserted in stations provided with more than 8 RF channels.

In stations with max. 8 RF channels the group shift relay, Re C, is omitted and two strappings are introduced in PS601 (see diagram of this unit).

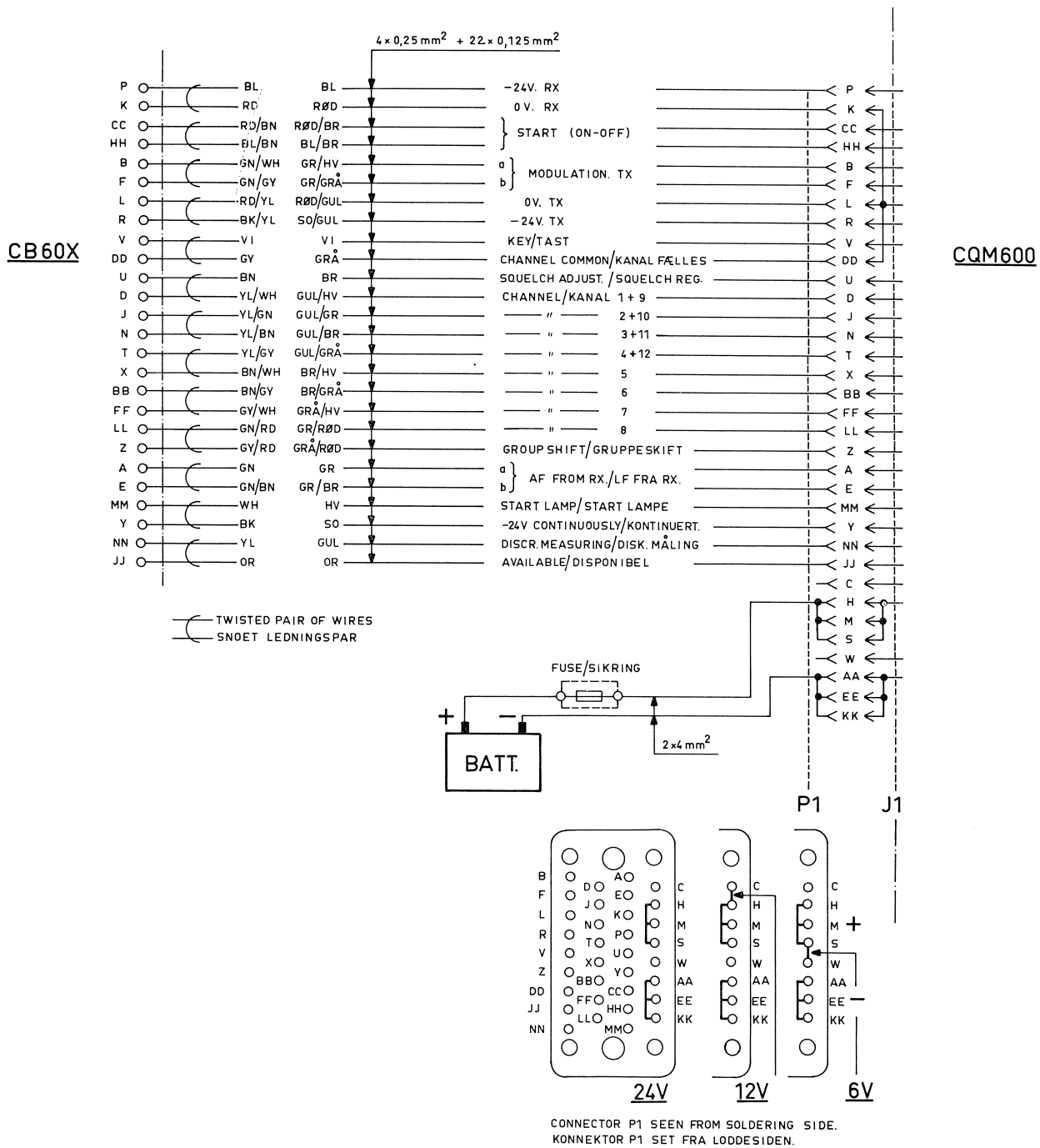
CABLEFORM KABLINGSDIAGRAM

NOTE 1. Relæ C er kun installeret i anlæg med over 8 kanaler.

I stationer med maksimalt 8 kanaler relæ C udeladt og to strapninger foretages da i PS601 (se diagram af denne enhed).

CQM66x SIMPELS

D400.874

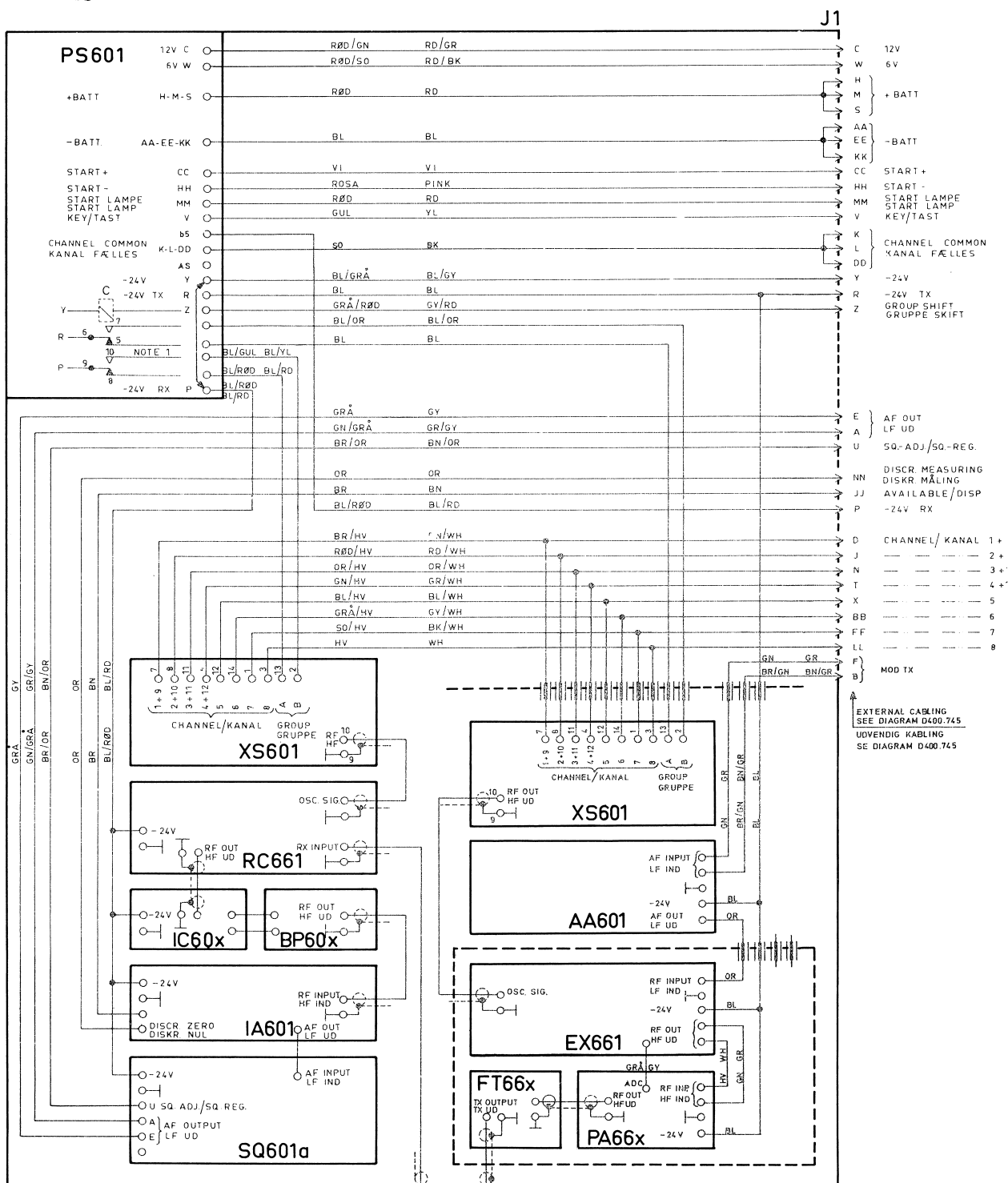


STANDARD INSTALLATION CABLING
STANDARD INSTALLATIONSKABLING

STORNOPHONE 600

Stereo

Stereo



ANT. RX ANT. TX

NOTE 1. Relay C is only inserted in stations provided with more than 8 RF channels.

In stations with max. 8 RF channels the group shift relay, Re C, is omitted and two strappings are introduced in PS601 (see diagram of this unit).

NOTE 1. Relæ C er kun installeret i anlæg med over 8 kanaler.

I stationer med maksimalt 8 kanaler relæ C udeladt og to stråpninger foretages da i PS601 (se diagram af denne enhed).

**CABLEFORM
KABLINGSDIAGRAM**

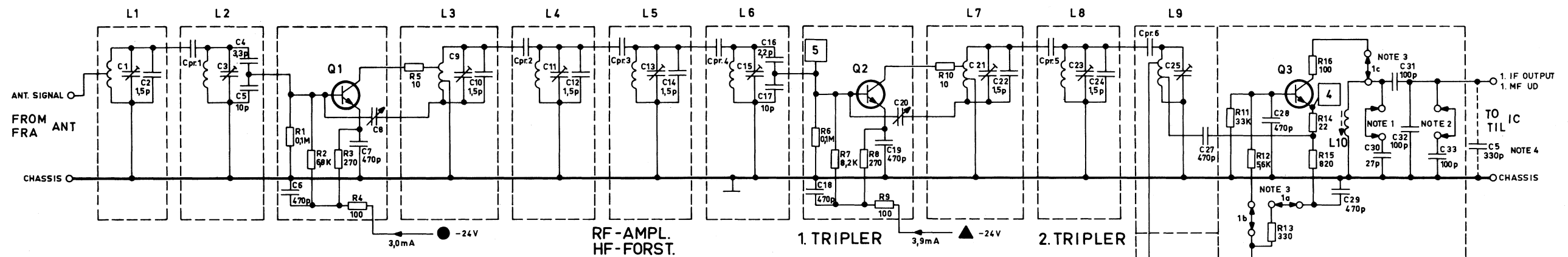
CQM66x DUPLEX

D401.089

1. SF

2. SF

MX



NOTE 1: STRAPPING FOR 50 kHz CHANNEL SEPARATION IN CONNECTION WITH IC601

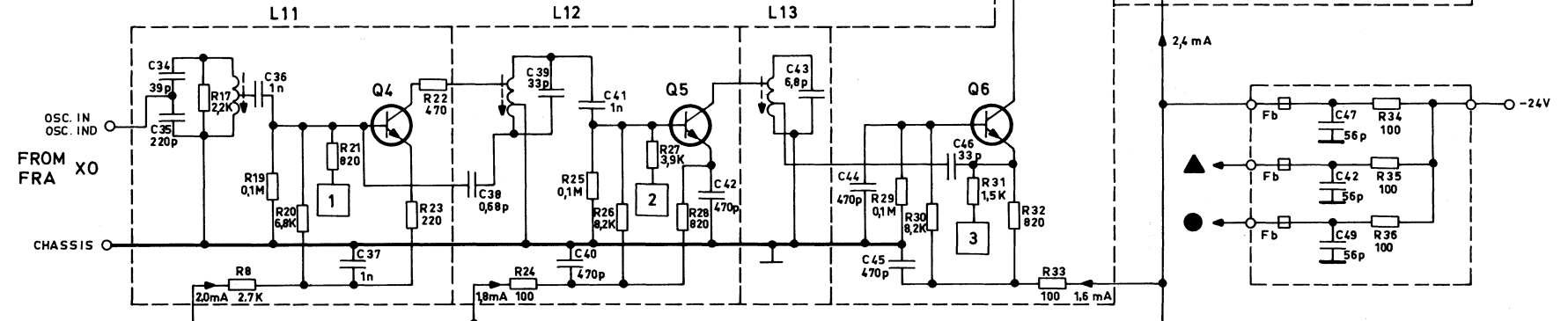
NOTE 2: STRAPPING FOR 25 OR 20 kHz CHANNEL SEPARATION IN CONNECTION WITH IC602, AND IC603 AND FOR 50 kHz, 25 kHz OR 20 kHz CHANNEL SEPARATION IN CONNECTION WITH IC601a, IC602a, OR IC605

NOTE 3: IN STATIONS WITH ONE RECEIVER CONVERTER UNIT THE STRAPPINGS DESIGNATED 1a, 1b, AND 1c ARE INSERTED IN STATIONS WITH SWITCHING BETWEEN TWO RECEIVER CONVERTERS STRAPPINGS DESIGNATED 1a, 1b AND 1c ARE OMITTED SEE INSTRUCTION 31.091

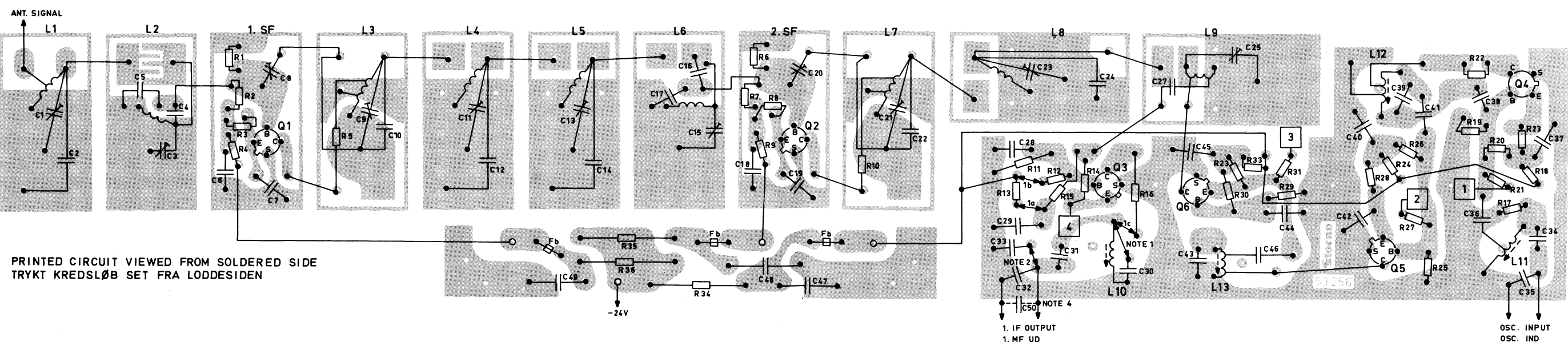
NOTE 1: STRAPPES VED 50 kHz KANALAFSTAND I FORBINDELSE MED IC601

NOTE 2: STRAPPES VED 25 kHz ELLER 20 kHz KANALAFSTAND I FORBINDELSE MED IC602 OG IC603 DESUDEN VED 50 kHz, 25 kHz ELLER 20 kHz KANALAFSTAND I FORBINDELSE MED IC601a, IC602a, IC603a OG IC605

NOTE 3: I ANLÆG MED EN MODTAGER KONVERTERENHED ER STRAPPINGERNE MRK. 1a, 1b OG 1c INDFØRT I ANLÆG MED SKIFT MELLEM TO MODTAGER KONVERTER-ENHEDER FJERNES STRAPPINGERNE 1a, 1b OG 1c. SE INSTRUKS 31.091



NOTE 4: C50 IS INSERTED IN CQL660 (F) C50 ISÆTTES I CQL660 (F)



PRINTED CIRCUIT VIEWED FROM SOLDERED SIDE
TRYKT KREDSLØB SET FRA LODDESIDEN

RECEIVER CONVERTER
MODTAGER KONVERTER

RC661

TYPE	NO.	CODE	DATA
	C1	78.5039	0.8-6.8 pF trimmer N150 TB
	C2	74.5176	1.5pF ± 0.25pF ceram N470 BD
	C3	78.5039	0.8-6.8pF trimmer N150 TB
	C4	74.5129	3.3pF ± 0.25pF ceram. N150 DI
	C5	74.5135	10pF 5% ceram. N150 DI
	C6	74.5161	470pF -20/+50% ceram PL
	C7	74.5161	470pF -20/+50% ceram PL
	C8	78.5038	0.8-3.8pF trimmer N200 TB
	C9	78.010	0.8-6.8pF trimmer N150 TB
	C10	74.5175	1.5pF ± 0.25pF ceram N330 BD
	C11	78.5039	0.8-6.8pF trimmer N150 TB
	C12	74.5176	1.5pF ± 0.25pF ceram N470 BD
	C13	78.5039	0.8-6.8pF trimmer N150 TB
	C14	74.5176	1.5pF ± 0.25pF ceram N470 BD
	C15	78.5039	0.8-6.8pF trimmer N150 TB
	C16	74.5127	2.2pF ± 0.25pF ceram N150 DI
	C17	74.5135	10pF 5% ceram N150 DI
	C18	74.5161	470pF -20/+50% ceram PL
	C19	74.5161	470pF -20/+50% ceram PL
	C20	78.5038	0.8-3.8pF trimmer N200 TB
	C21	78.010	0.8-6.8pF trimmer N150 TB
	C22	74.5175	1.5pF ± 0.25pF ceram N330 BD
	C23	78.010	0.8-6.8pF trimmer N150 TB
	C24	74.5176	1.5pF ± 0.25pF ceram N470 BD
	C25	78.5039	0.8-6.8pF ceram N150 TB
	C27	74.5161	470pF -20/+50% ceram PL
	C28	74.5161	470pF -20/+50% ceram PL
	C29	74.5161	470pF -20/+50% ceram PL
	C30	74.5107	27pF 2% ceram NO75 TB
	C31	76.5079	100pF 5% polystyr. TB
	C32	76.5079	100pF 5% polystyr. TB
	C33	76.5079	100pF 5% polystyr. TB
	C34	74.5117	39pF 2% ceram NO75 TB
	C35	76.5063	220pF 5% polystyr. TB
	C36	74.5155	1 nF -20/+50% ceram PL
	C37	76.5069	1 nF 10% polyester. FL
	C38	74.5121	0.68pF ± 0.1pF ceram P100 BD
	C39	74.5116	33pF 2% ceram NO75 TB
	C40	74.5161	470pF -20/+50% ceram PL
	C41	74.5155	1 nF -20/+50% ceram PL
	C42	74.5116	470pF -20/+50% ceram PL
	C43	74.5133	6.8pF ± 0.25pF ceram N150DI
	C44	74.5161	470pF -20/+50% ceram PL
	C45	74.5161	470pF -20/+50% ceram PL
	C46	74.5116	33pF 2% ceram NO75 TB
	C47	74.5111	56pF 2% ceram NO75 TB
	C48	74.5111	56pF 2% ceram NO75 TB
	C49	74.5111	56pF 2% ceram NO75 TB

TYPE	NO.	CODE	DATA
	R1	80.5073	0.1 MΩ 5% carbon film
	R2	80.5059	6.8 kΩ 5%
	R3	80.5042	270 Ω 5%
	R4	80.5037	100 Ω 5%
	R5	80.5025	10 Ω 5%
	R6	80.5073	0.1MΩ 5%
	R7	80.5060	8.2 kΩ 5%
	R8	80.5042	270 Ω 5%
	R9	80.5037	100 Ω 5%
	R10	80.5025	10 Ω 5%
	R11	80.5267	33 kΩ 5%
	R12	80.5258	5.6 kΩ 5%
	R13	80.5243	330 Ω 5%
	R14	80.5229	22 Ω 5%
	R15	80.5248	820 Ω 5%
	R16	80.5237	100 Ω 5%
	R17	80.5253	2.2 kΩ 5%
	R18	80.5254	2.7 kΩ 5%
	R19	80.5273	0.1MΩ 5%
	R20	80.5259	6.8 kΩ 5%
	R21	80.5248	820 Ω 5%
	R22	80.5245	470 Ω 5%
	R23	80.5241	220 Ω 5%
	R24	80.5237	100 Ω 5%
	R25	80.5273	0.1 MΩ 5%
	R26	80.5260	8.2 kΩ 5%
	R27	80.5256	3.9 kΩ 5%
	R28	80.5248	820 Ω 5%
	R29	80.5273	0.1MΩ 5%
	R30	80.5260	8.2 kΩ 5%
	R31	80.5251	1.5 kΩ 5%
	R32	80.5248	820 Ω 5%
	R33	80.5237	100 Ω 5%
	R34	80.5237	100 Ω 5%
	R35	80.5237	100 Ω 5%
	R36	80.5237	100 Ω 5%
	L1	62.733	RF coil/HF-spole 420-470 MHz
	L2	62.735	RF coil/HF-spole 420-470 MHz
	L3	62.733	RF coil/HF-spole 420-470 MHz
	L4	62.735	RF coil/HF-spole 420-470 MHz
	L5	62.735	RF coil/HF-spole 420-470 MHz

RECEIVER CONVERTER
MODTAGER KONVERTER

RC661

X400.735/2

Storno

Storno

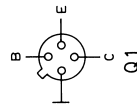
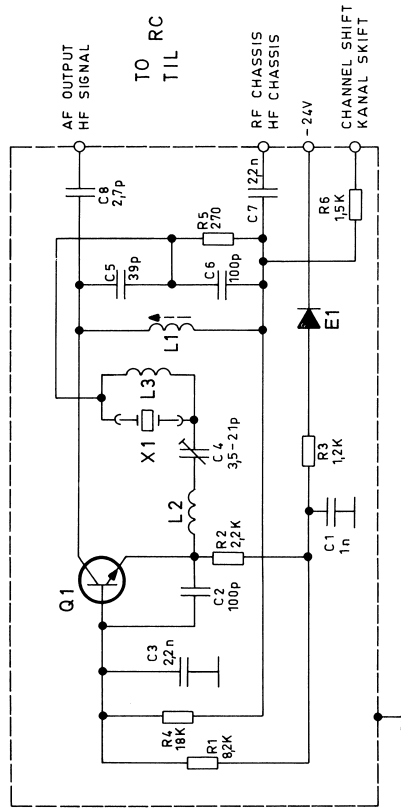
TYPE	NO.	CODE	DATA
	L6 L7 L8 L9 L10 L11 L12 L13	62.735 62.733 62.735 62.734 61.992 61.989 61.990 61.991	RF coil/HF-spole 420-470 MHz RF coil/HF-spole 420-470 MHz RF coil/HF-spole 420-470 MHz RF coil/HF-spole 420-470 MHz IF coil/HF-spole 10,7 MHz RF coil/HF-spole 45,5-51,5 MHz RF coil/HF-spole 45,5-51,5 MHz RF coil/HF-spole 136-154 MHz
	Q1 Q2 Q3 Q4 Q5 Q6	99.5186 99.5186 99.5186 99.5186 99.5186 99.5186	Transistor BF161 Transistor BF161 Transistor BF161 Transistor BF161 Transistor BF161 Transistor BF161

TYPE	NO.	CODE	DATA

RECEIVER CONVERTER
MODTAGER KONVERTER

RC661

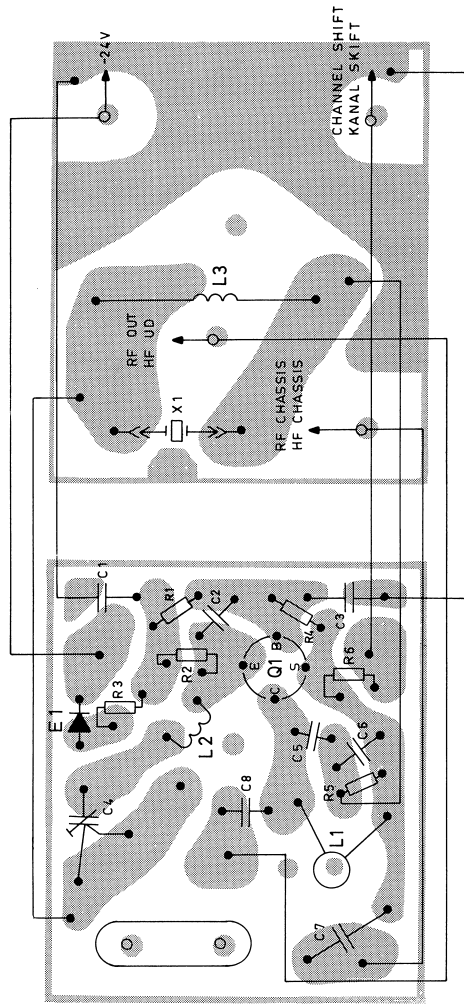
X400.735/2



BOTTOM VIEW
SET FRA BUNDEN

UPPER PRINTED WIRING BOARD VIEWED
FROM COMPONENT SIDE
ØVERSTE TRYKTE KREDSLØB SET
FRA KOMPONENTSIDEN

LOWEST PRINTED WIRING BOARD VIEWED
FROM COMPONENT SIDE
NEDERSTE TRYKTE KREDSLØB SET
FRA KOMPONENTSIDEN



CRYSTALOSCILLATOR
FOR RX.

XO611a

D400.667/4

Storno

TYPE	NO.	CODE	DATA
	C1	76.5069	1nF 10% polyester FL 50V
	C2	76.5102	100pF 2,5% polystyr 30V
	C3	76.5059	2,2nF 10% polystyr FL 50V
	C4	78.5033	3,5-21pF trimmer ceram NPOTB 125V
	C5	74.5117	39 pF ±2% ceram NO75TB 250V
	C6	76.5102	100pF 2,5% polystyr 30V
	C7	76.5059	2,2nF 10% polyester FL 50V
	C8	74.5128	2,7pF ±0,25pF ceram N150BD 250V
	R1	80.5260	8,2kΩ 5% carbon film 1/8W
	R2	80.5253	2,2kΩ 5% " " 1/8W
	R3	80.5250	1,2kΩ 5% " " 1/8W
	R4	80.5264	18 kΩ 5% " " 1/8W
	R5	80.5242	270Ω 5% " " 1/8W
	R6	80.5251	1,5 kΩ 5% " " 1/8W
	E1	99.5028	Diode OA200
	L1	61.876	RF coil/HF -spole 48-57 MHz
	L2	62.662	Filter coil/Drosselspole
	L3	62.661	Filter coil/Drosselspole
	Q1	99.5028	Transistor BF167
	X1		Crystal

Storno

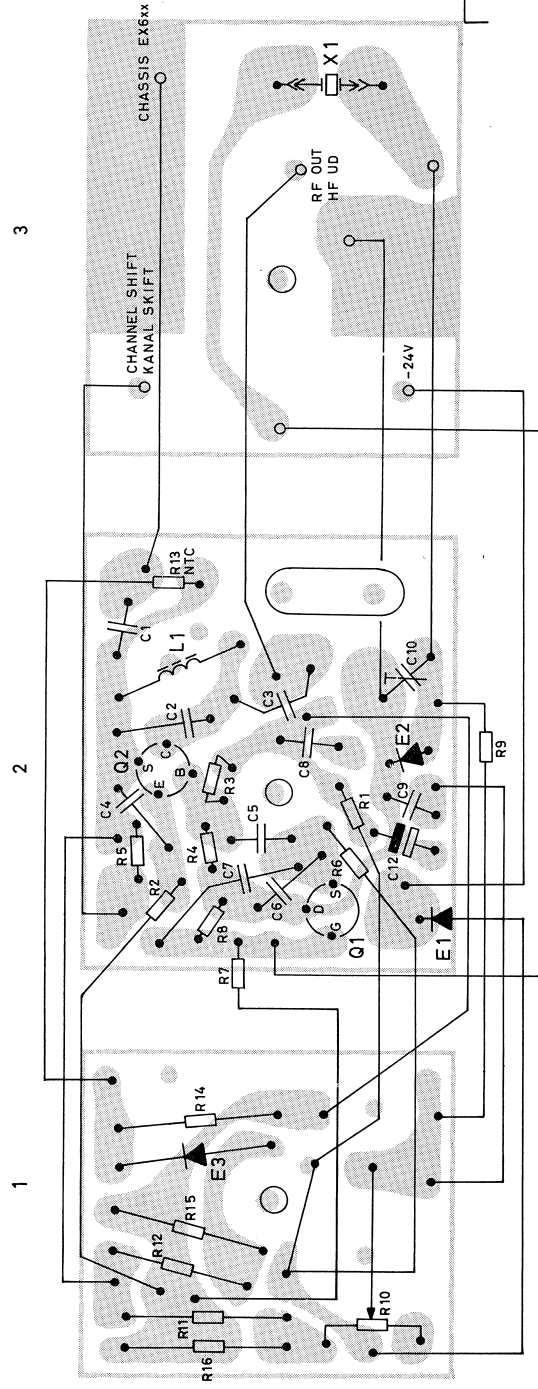
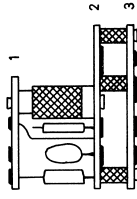
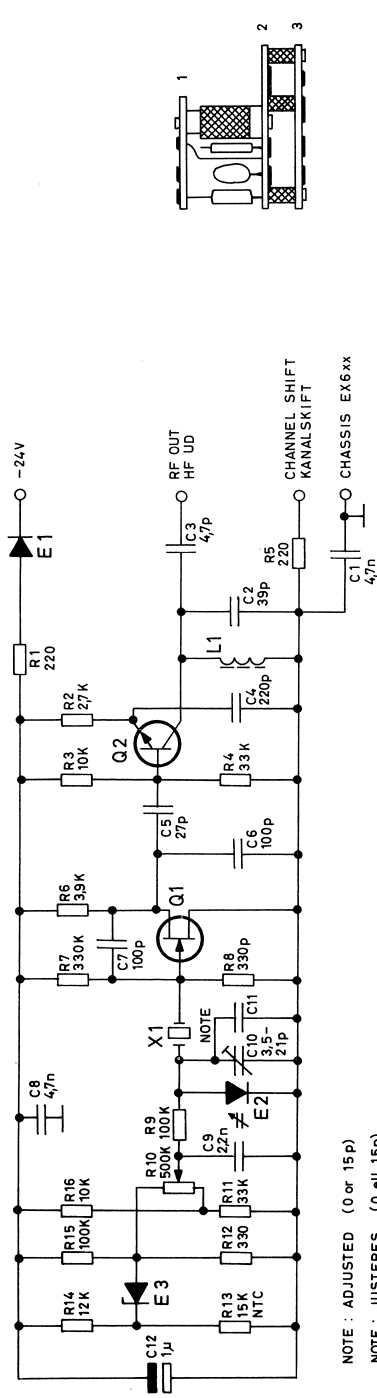
TYPE	NO.	CODE	DATA

CRYSTALOSCILLATOR

XO611

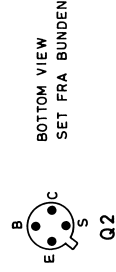
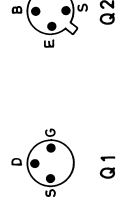
FOR RX.

X400.686/2



PRINTED CIRCUIT VIEWED FROM SOLDERING SIDE
TRYKT KREDSLØB SET FRA LODDESIDEN

PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE
TRYKT KREDSLØB SET FRA KOMPONENTSIDEN



CRYSTAL OSCILLATOR
KRYSTAL OSCILLATOR

XO662

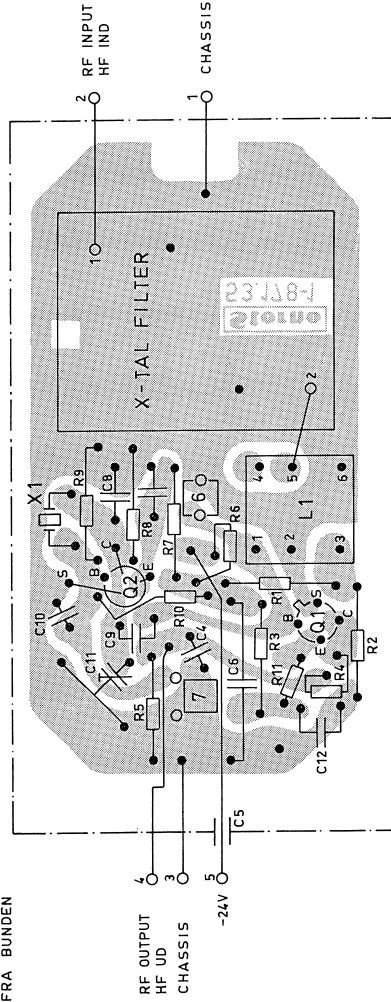
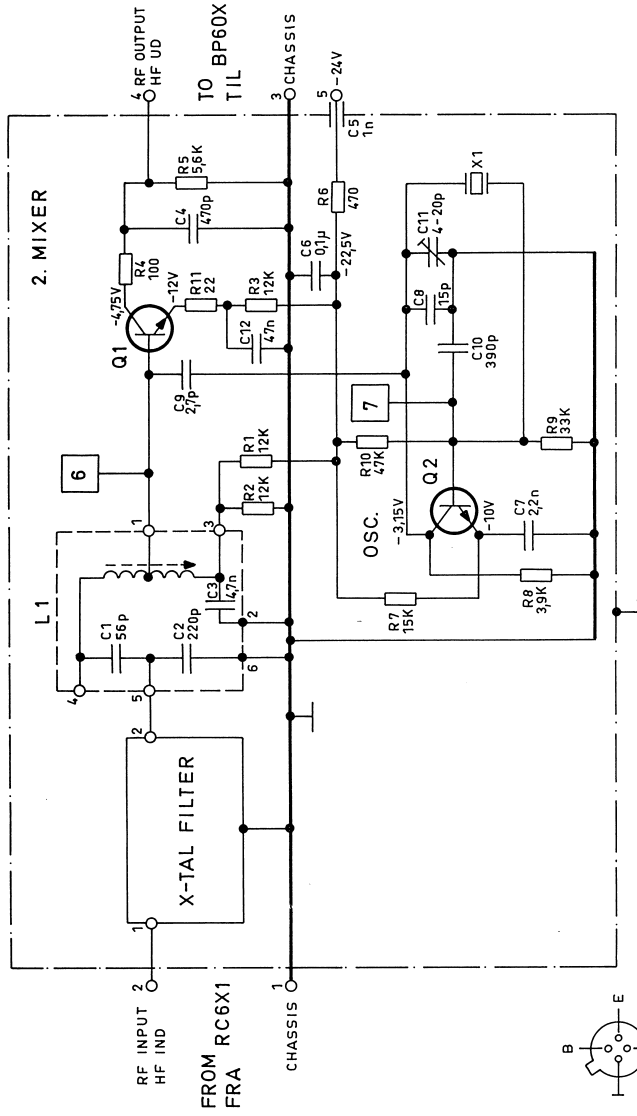
D400.837/2

Storno**Storno**

TYPE	NO.	CODE	DATA
C1	76.5061	4, 7 nF 10% polyester. FL	50V
C2	74.5117	39 pF 2% ceram N075 TB	250V
C3	74.5131	4, 7 pF ± 0, 25pF ceram N150 DI	250V
C4	76.5104	220pF 2, 5% polystyr.	30V
C5	74.5107	27 pF 2% ceram N075 TB	250V
C6	76.5102	100 pF 2, 5% polystyr	30V
C7	76.5102	100 pF 2, 5% polystyr	30V
C8	76.5061	4, 7 nF 10% polyester. FL	50V
C9	74.5163	2, 2 nF -20+50% ceram II PL	63V
C10	78.5033	3, 5/21pF ceram trimmer NPO	500V
C11	74.51xx	Adjusted/tilpasset	
C12	73.5114	1 µF 20% tantal	30V
R1	80.5041	220Ω 5% carbon film	0, 1W
R2	80.5054	2, 7 kΩ 5% carbon film	0, 1W
R3	80.5061	10 kΩ 5% carbon film	0, 1W
R4	80.5067	33 kΩ 5% carbon film	0, 1W
R5	80.5041	220 Ω 5% carbon film	0, 1W
R6	80.5056	3, 9 kΩ 5% carbon film	0, 1W
R7	80.5079	330 kΩ 5% carbon film	0, 1W
R8	80.5079	330 kΩ 5% carbon film	0, 1W
R9	80.5073	100 kΩ 5% carbon film	0, 1W
R10	86.008	500 kΩ 20% potm. Lin. carb. film	0, 05W
R11	80.5067	33 kΩ 5% carbon film	0, 1W
R12	80.5079	330 kΩ 5% carbon film	0, 1W
R13	89.5010	15 kΩ 20% NTC	0, 6W
R14	80.5062	12 kΩ 5% carbon film	0, 1W
R15	80.5073	100 kΩ 5% carbon film	0, 1W
R16	80.5061	10 kΩ 5% carbon film	0, 1W
L1	61.1015	RF-coil/HF-spole 45-57 MHz	
E1	99.5028	Diode 1N914	
E2	99.5203	Diode HC7008	
E3	99.5042	Zenerdiode 9, 1V 5%	0, 4W
Q1	99.5204	Transistor 2N4303	
Q2	99.5177	Transistor BF166	

CRYSTALOSCILLATOR XO662

X400. 871



IF-CONVERTER
MF-KONVERTER

IC601b, IC602b, IC603b

Storno

Storno

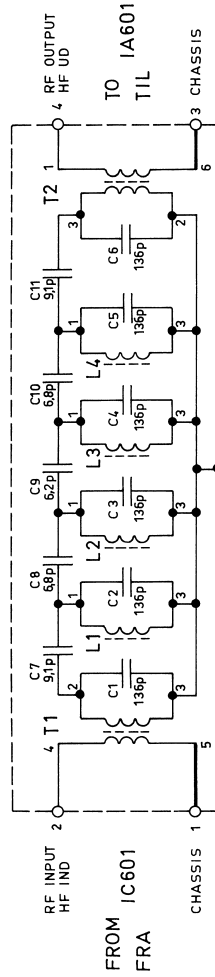
TYPE	NO.	CODE	DATA
	C1	74.5111	56 pF 2% ceram NO75 TB
	C2	76.5063	220 pF 5% polystyr. TB
	C3	76.5061	4,7nF 10% polyester. FL
	C4	76.5065	470 pF 5% polystyr. TB
	C5	74.5167	1 nF -20/+50% ceram. FT
	C6	76.5073	0,1μF 10% polyester. TB
	C7	76.5059	2,2nF 10% FL
	C8	74.5142	18 pF ±0.5pF ceram. NO75 TB
	C9	74.5107	2,7pF 2% " NO75 TB
	C10	76.5017	390 pF 5% polystyr. TB
	C11	78.5031	40/20pF ceram trimmer N470 DI
	C12	76.5072	47 nF 10% polyester. 50V
	R1	80.5262	12 kΩ 5% carbon film
	R2	80.5262	12 kΩ 5% " "
	R3	80.5262	12 kΩ 5% " "
	R4	80.5237	100 Ω 5% " "
	R5	80.5258	5,6kΩ 5% " "
	R6	80.5245	470Ω 5% " "
	R7	80.5263	15 kΩ 5% " "
	R8	80.5256	3,9kΩ 5% " "
	R9	80.5267	33 kΩ 5% " "
	R10	80.5269	47 kΩ 5% " "
	R11	80.5229	22 Ω 5% " "
	L1	61.977	Coil/spole 10.7 MHz (C1, C2, C3)
	Q1	99.5166	Transistor BF 167
	Q2	99.5166	Transistor BF 167
	X1	98.5004	10.2450 MHz crystal, Storno type 98-8 or/eller
IC601b		98.5005	11.1550 MHz crystal, Storno type 98-8
IC602b		69.5010	10.7 MHz X-tal filter/krystalfilter 50 kHz
IC603b		69.5009	10.7 MHz X-tal filter/krystalfilter 25 kHz
		69.5008	10.7 MHz X-tal filter/krystalfilter 20 kHz

TYPE	NO.	CODE	DATA

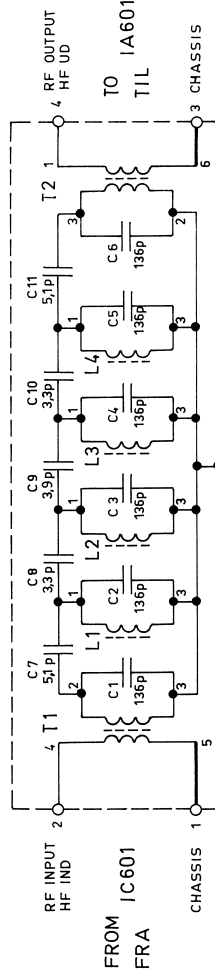
IF-CONVERTER
MF-KONVERTER

IC601b, IC602b, IC603b

X400.684/3



BP601



BP602

BAND-PASS FILTER
BÅNDPASSFILTER

BP601, BP602

Storno

IF.1

IF.2

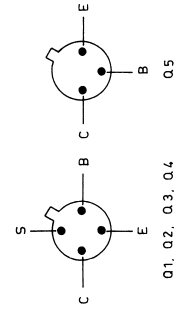
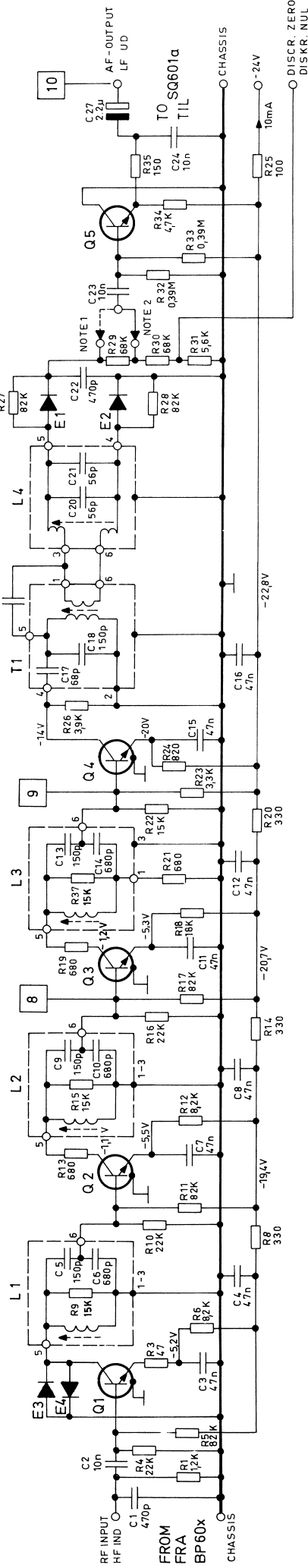
LI.1

LI.2

DISCR.

AF

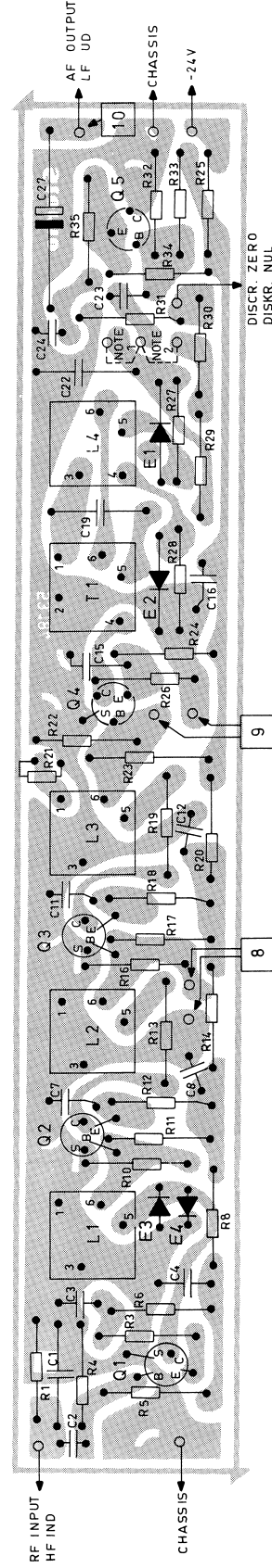
Storno



NOTE 1. CONNECTION FOR $\pm 4\text{kHz}$ OR $\pm 5\text{kHz}$ FREQ. DEVIATION
NOTE 2. CONNECTION FOR $\pm 15\text{kHz}$ FREQ. DEVIATION

NOTE 1. FORBINDELSE VED $\pm 4\text{kHz}$ ELLER $\pm 5\text{kHz}$ FREKVENSSVING.
NOTE 2. FORBINDELSE VED $\pm 15\text{kHz}$ FREKVENSSVING.

PRINTED CIRCUIT SEEN FROM COMPONENT SIDE
TRYKT KREDSLØB SET FRA KOMPONENTSIDEN



IF-AMPLIFIER
MF-FORSTÆRKER

IA601c

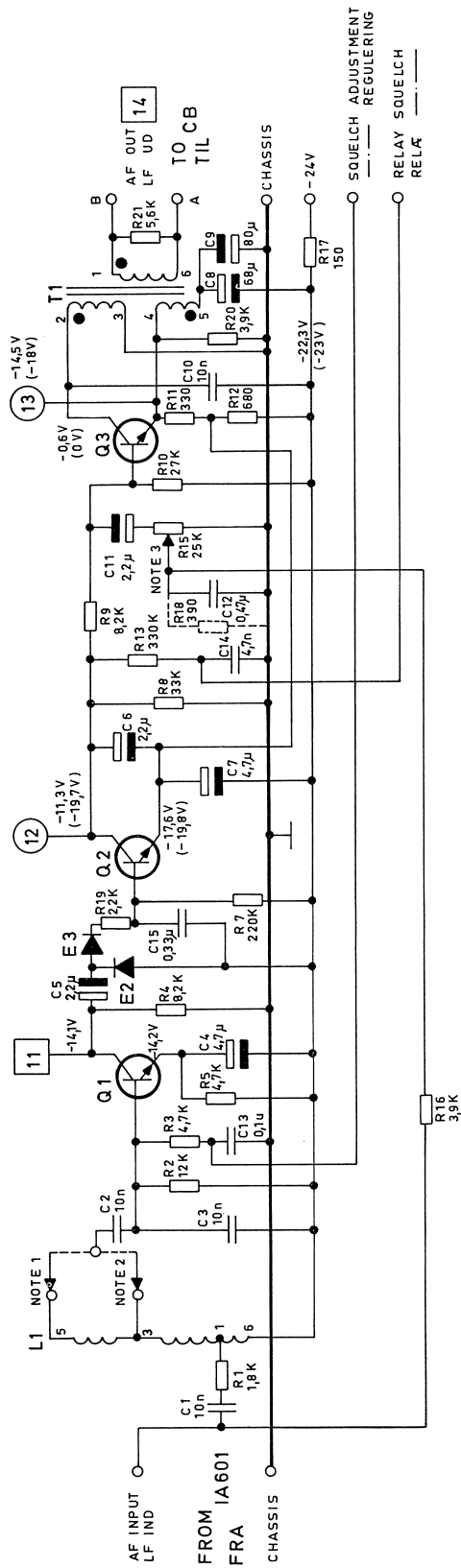
D401.042/3

TYPE	NO.	CODE	DATA
	C1	76. 5065	470 pF 5% polystyr TB
	C2	76. 5070	10 nF 10% polyester. FL
	C3	76. 5072	47 nF 10% polyester. FL
	C4	76. 5072	47 nF 10% polyester. FL
	C5	76. 5103	150 pF 2, 5% polystyr TB
	C6	76. 5107	680 pF 2, 5% polystyr TB
	C7	76. 5072	47 nF 10% polyester. FL
	C8	76. 5072	47 nF 10% polyester. FL
	C9	76. 5103	150 pF 2, 5% polyester. TB
	C10	76. 5107	680 pF 2, 5% polystyr. TB
	C11	76. 5072	47 nF 10% polyester. FL
	C12	76. 5072	47 nF 10% polyester. FL
	C13	76. 5103	150 pF 2, 5% polystyr. TB
	C14	76. 5107	680 pF 2, 5% polystyr. TB
	C15	76. 5072	47 nF 10% polyester. FL
	C16	76. 5072	47 nF 10% polyester. FL
	C17	76. 5101	68 pF 2, 5% polystyr. TB
	C18	76. 5103	150 pF 2, 5% polystyr TB
	C19	76. 5065	470 pF 5% polystyr TB
	C20	74. 5111	56 pF 2% ceram. NO75 TB
	C21	74. 5111	56 pF 2% ceram. NO75 TB
	C22	76. 5065	470 pF 5% polystyr. TB
	C23	76. 5070	10 nF 10% polyester. FL
	C24	76. 5070	10 nF 10% polyester. FL
	C27	73. 5064	2. 2 μ F -10+100% elco
	R1	80. 5250	1, 2 k Ω 5% carbon film
	R3	80. 5233	47 Ω 5% carbon film
	R4	80. 5265	22 k Ω 5% carbon film
	R5	80. 5272	82 k Ω 5% carbon film
	R6	80. 5260	8, 2 k Ω 5% carbon film
	R8	80. 5243	330 Ω 5% carbon film
	R9	80. 5064	18 k Ω 5% carbon film
	R10	80. 5265	22 k Ω 5% carbon film
	R11	80. 5272	82 k Ω 5% carbon film
	R12	80. 5260	8, 2 k Ω 5% carbon film
	R13	80. 5247	680 Ω 5% carbon film
	R14	80. 5243	330 Ω 5% carbon film
	R15	80. 5064	18 k Ω 5% carbon film
	R16	80. 5265	22 k Ω 5% carbon film
	R17	80. 5272	82 k Ω 5% carbon film
	R18	80. 5264	18 k Ω 5% carbon film
	R19	80. 5247	680 Ω 5% carbon film
	R20	80. 5243	330 Ω 5% carbon film
	R21	80. 5247	680 Ω 5% carbon film
	R22	80. 5263	15 k Ω 5% carbon film
	R23	80. 5255	3, 3 k Ω 5% carbon film
	R24	80. 5248	820 Ω 5% carbon film

TYPE	NO.	CODE	DATA
	R25	80. 5237	100 Ω 5% carbon film
	R26	80. 5256	3, 9 k Ω 5% carbon film
	R27	80. 5272	82 k Ω 5% carbon film
	R28	80. 5272	82 k Ω 5% carbon film
	R29	80. 5271	68 k Ω 5% carbon film
	R20	80. 5271	68 k Ω 5% carbon film
	R31	80. 5258	5, 6 k Ω 5% carbon film
	R32	80. 5280	0, 39 M Ω 5% carbon film
	R33	80. 5280	0, 39 M Ω 5% carbon film
	R34	80. 5257	4, 7 k Ω 5% carbon film
	R35	80. 5239	150 Ω 5% carbon film
	R37	80. 5064	18 k Ω 5% carbon film
	L1	61. 811-02	Coil/spole 455 kHz (C5-C6-R9)
	L2	61. 811-02	Coil/spole 455 kHz (C9-C10-R15)
	L3	61. 811-02	Coil/spole 455 kHz (C13-C14-R37)
	L4	61. 813-01	Coil/spole 455 kHz discr. (C20-C21)
	T1	61. 812-02	Trafo 455 kHz (C17-C18)
	E1	99. 5028	Diode 1N914
	E2	99. 5028	Diode 1N914
	E3	99. 5028	Diode 1N914
	E4	99. 5021	Diode 1N914
	Q1	99. 5166	Transistor BF167
	Q2	99. 5166	Transistor BF167
	Q3	99. 5166	Transistor BF167
	Q4	99. 5168	Transistor BF173

IF -AMPLIFIER
MF -FORSTÆRKER
IA601c

X400.797/4



NOTE 1. CONNECTED IF 20 OR 25KHz CHANNEL SEPARATION IS USED.

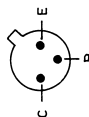
NOTE 2. CONNECTED IF 50KHz CHANNEL SEPARATION IS USED.

NOTE 3. IF FM IS USED INSTEAD OF PM, C12 IS REPLACED BY R18(390 Ω).

NOTE 1. STRAPPES VED 20/25KHz KANALAFSTAND.

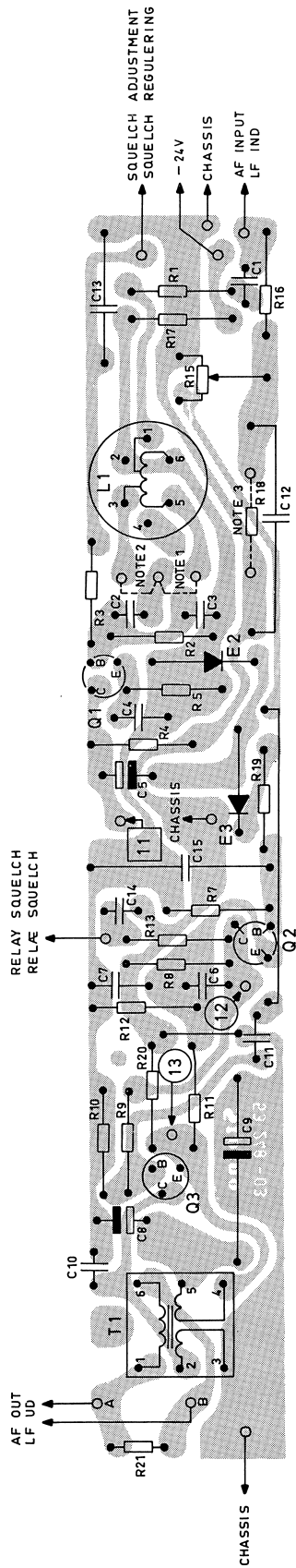
NOTE 2. STRAPPES VED 50KHz KANALAFSTAND.

NOTE 3. VED FM UDBYTTES C12 MED R18(390 Ω).



Q1, Q2 Q3
BOTTOM VIEW
SET FRA BUNDEN

PRINTED CIRCUIT SEEN FROM COMPONENT SIDE
TRYKT KREDSLØB SET FRA KOMPONENTSIDEN



AF-AMPLIFIER AND SQUELCH
LF-FORSTÆRKER OG SQUELCH

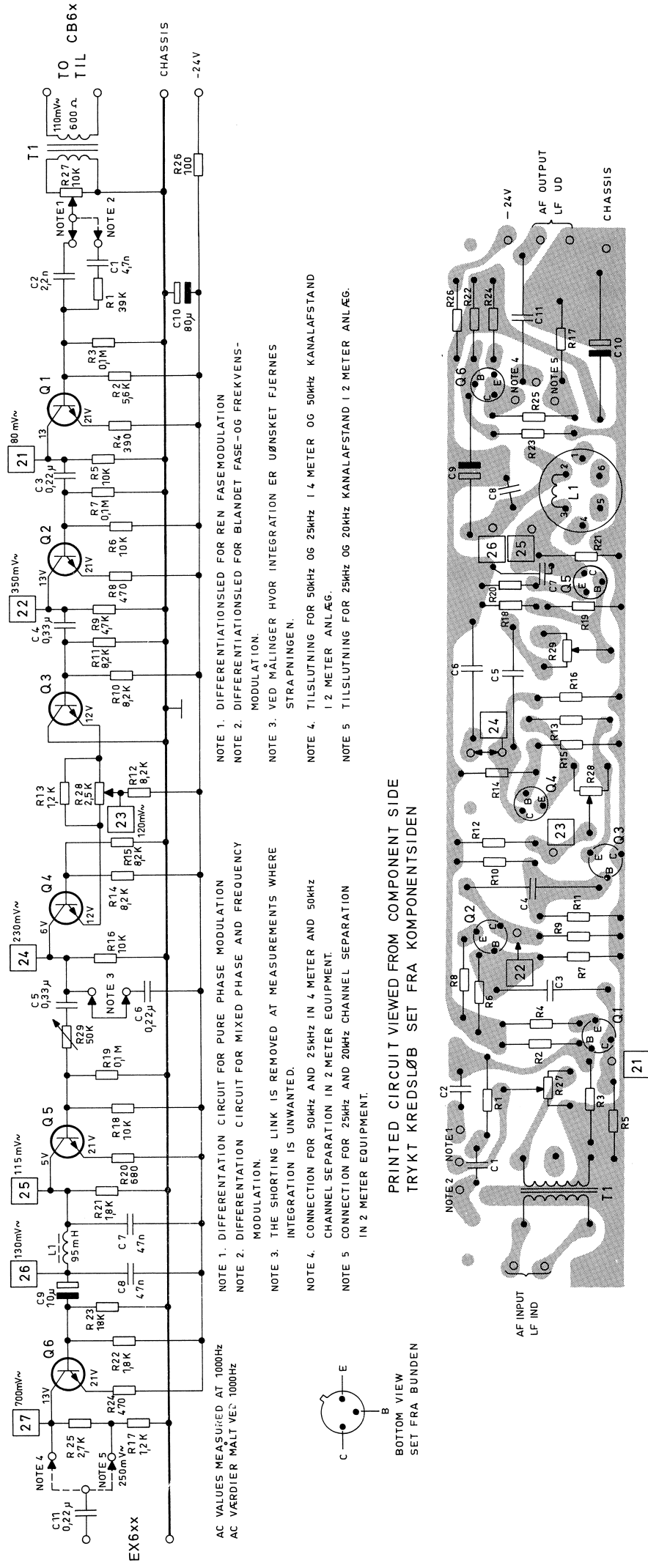
SQ601a

D400.661/4

DIFFERENTIATOR

1. FORSTÆRKER

AA601



Storno

Storno

TYPE	NO.	CODE	DATA
	C1	76.5061	4, 7nF 10% polyester. FL
	C2	76.5059	2, 2nF 10% polyester. FL
	C3	76.5074	0, 22uF 10% polyester. TB
	C4	76.5075	0, 3uF 10% polyester. TB
	C5	76.5075	0, 3uF 10% polyester. TB
	C6	76.5074	0, 22uF 10% polyester. TB
	C7	76.5072	47nF 10% polyester. FL
	C8	76.5072	47nF 10% polyester. FL
	C9	73.5001	10uF -10 +50% elco
	C10	73.5110	80uF -10 +50% elco
	C11	76.5074	0, 22uF 10% polyester. TB
	R1	80.5268	39kΩ 5% carbon film
	R2	80.5258	5, 6kΩ 5% carbon film
	R3	80.5273	100kΩ 5% carbon film
	R4	80.5244	390Ω 5% carbon film
	R5	80.5261	10kΩ 5% carbon film
	R6	80.5261	10kΩ 5% carbon film
	R7	80.5273	100kΩ 5% carbon film
	R8	80.5245	470Ω 5% carbon film
	R9	80.5257	4, 7kΩ 5% carbon film
	R10	80.5260	8, 2kΩ 5% carbon film
	R11	80.5260	8, 2kΩ 5% carbon film
	R12	80.5260	8, 2kΩ 5% carbon film
	R13	80.5250	1, 2kΩ 5% carbon film
	R14	80.5260	8, 2kΩ 5% carbon film
	R15	80.5260	8, 2kΩ 5% carbon film
	R16	80.5261	10kΩ 5% carbon film
	R17	80.5250	1, 2kΩ 5% carbon film
	R18	80.5261	10kΩ 5% carbon film
	R19	80.5273	100kΩ 5% carbon film
	R20	80.5247	680Ω 5% carbon film
	R21	80.5252	1, 8kΩ 5% carbon film
	R22	80.5252	1, 8kΩ 5% carbon film
	R23	80.5264	18 kΩ 5% carbon film
	R24	80.5245	470Ω 5% carbon film
	R25	80.5254	2, 7kΩ 5% carbon film
	R26	80.5237	100Ω 5% carbon film
	R27	86.5039	10kΩ 20% trim lin
	R28	86.5043	2, 5kΩ 20% trim lin
	R29	86.5040	50 kΩ 20% trim lin
	L1	61.824	Filter coil/Filterspole
	T1	60.5130	Transformer LF600/1000Ω
	Q1	99.5143	Transistor BC108
	Q2	99.5143	Transistor BC108
	Q3	99.5143	Transistor BC108

TYPE	NO.	CODE	DATA
	Q4	99.5143	Transistor BC108
	Q5	99.5143	Transistor BC108
	Q6	99.5143	Transistor BC108

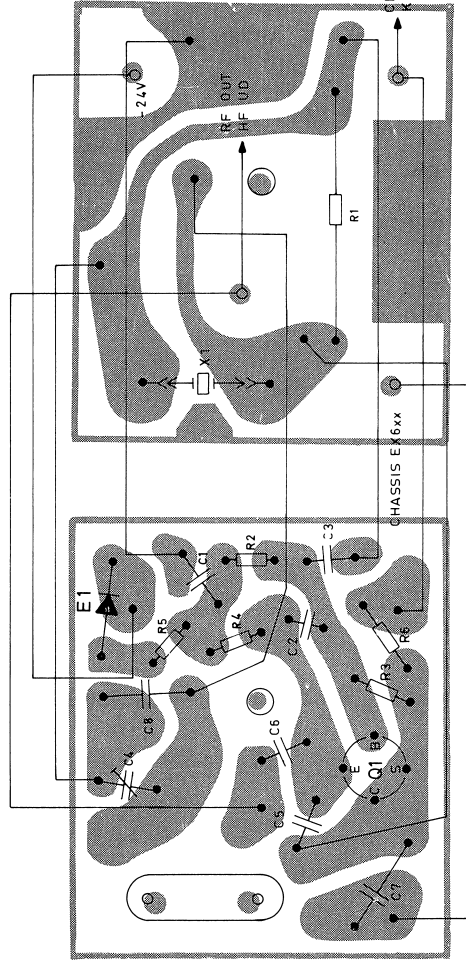
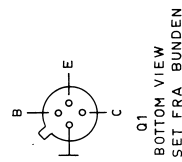
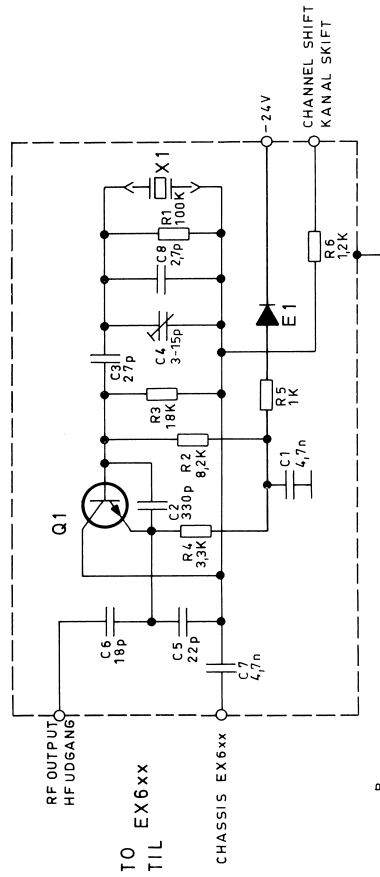
AF-AMPLIFIER
LF-FORSTÆRKER

AA601

X400.683/3

UPPER PRINTED WIRING BOARD VIEWED
FROM COMPONENT SIDE
ØVERSTE TRYKTE KREDSLØB SET
FRA KOMPONENTSIDEN

LOWEST PRINTED WIRING BOARD VIEWED
FROM COMPONENT SIDE
NEDERSTE TRYKTE KREDSLØB SET
FRA KOMPONENTSIDEN



CRYSTALOSCILLATOR
FOR TX.

XO631a

D400.666/3

Storno

TYPE	NO.	CODE	DATA
C1	76.5061	4, 7nF \pm 10% polyester FL	50V
C2	76.5105	330pF 2, 5% polystyren	30V
C3	74.5107	27pF \pm 0, 5pF ceram NO75TB	250V
C4	78.5032	3-15pF trimmer ceram NPOTB	500V
C5	74.5106	22 pF \pm 0, 5pF ceram NO75TB	250V
C6	74.5142	18 pF \pm 0, 5pF " NO75TB	250V
C7	76.5061	4, 7nF \pm 10% polyester	50V
C8	74.5128	2, 7pF \pm 0, 25pF ceram NI50DI	250V
R1	80.5273	100 k Ω 5% carbon film	1/8W
R2	80.5260	8, 2 k Ω 5% " "	1/8W
R3	80.5264	18 k Ω 5% " "	1/8W
R4	80.5255	3, 3k Ω 5% " "	1/8W
R5	80.5249	1 k Ω 5% " "	1/8W
R6	80.5250	1, 2 k Ω 5% " "	1/8W
E1	99.5028	Diode OA200	
Q1	99.5118	Transistor BF115	
X1	98.	Crystal	

Storno

TYPE	NO.	CODE	DATA

CRYSTALOSCILLATOR

XO631

FOR TX.

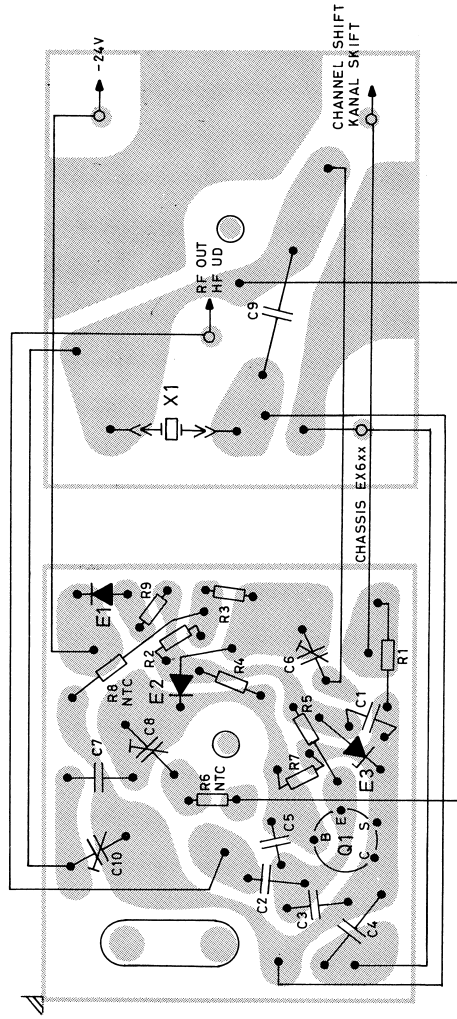
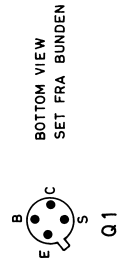
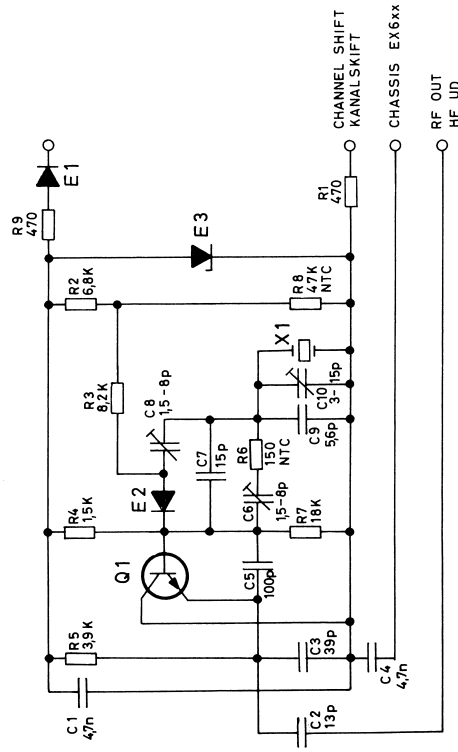
X400, 680/2

UPPER PRINTED WIRING BOARD
VIEWED FROM COMPONENT SIDE

ØVERSTE TRYKTE KREDSLØB SET
FRA KOMPONENTSIDEN

LOWEST PRINTED WIRING BOARD
VIEWED FROM COMPONENT SIDE

NEDERSTE TRYKTE KREDSLØB SET
FRA KOMPONENTSIDEN



CRYSTAL OSCILLATOR
KRYSTAL OSCILLATOR

XO661

D400.730/2

Storno

TYPE	NO.	CODE	DATA
	C1	76. 5061	4, 7 nF 10% polyester. FL
	C2	74. 5136	12 pF 5% ceram N150 DI
	C3	74. 5117	39 pF 2% ceram NO75 TB
	C4	76. 5061	4, 7 nF 10% polyester. FL
	C5	76. 5102	100 pF 2, 5% polystyr.
	C6	78. 5034	1, 5/8 pF ceram trimmer NPO
	C7	74. 5173	15 pF 5% ceram N750 DI
	C8	78. 5034	1, 5/8 pF ceram trimmer NPO
	C9	74. 5132	5, 6 pF ± 0, 25 pF ceram N150 DI
	C10	78. 5033	3, 5/21 pF ceram trimmer NPO
	R1	80. 5045	470 Ω 5% carbon film
	R2	80. 5059	6, 8 kΩ 5% carbon film
	R3	80. 5060	8, 2 kΩ 5% carbon film
	R4	80. 5063	15 kΩ 5% carbon film
	R5	80. 5056	3, 9 kΩ 5% carbon film
	R6	89. 5034	150 Ω 20% NTC
	R7	80. 5064	18 kΩ 5% carbon film
	R8	89. 5035	47 kΩ 20% NTC
	R9	80. 5045	470 Ω 5% carbon film
	E1	99. 5028	Diode 1N914
	E2	99. 5028	Diode 1N914
	E3	99. 5184	Zenerdiode BZX22 20V 5%
	Q1	99. 5177	Transistor BF166

Storno

TYPE	NO.	CODE	DATA

CRYSTAL OSCILLATOR
KRYSTAL OSCILLATOR

XO661

X400. 870/2

Storno

Storno

2. PA

1. PA

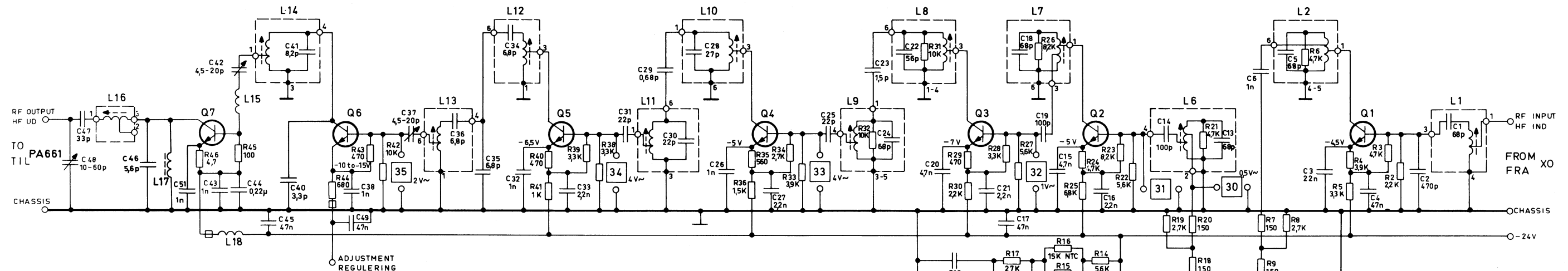
2. DOUBLER
2. DOBLER

TRIPLER

1. DOUBLER
1. DOBLER

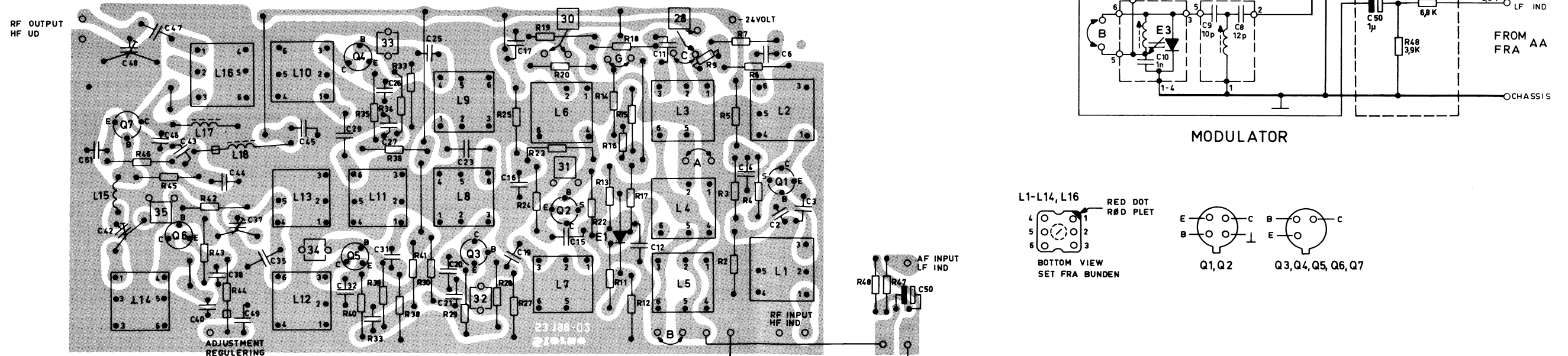
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1. BUFFER

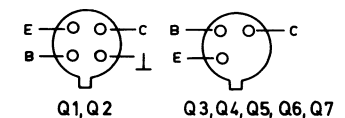


PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE
TRYKT KREDSLØB SET FRA KOMPONENTSIDEN

RF VALUES MEASURED WITH RF-PROBE STORNO NR 95,089
DC VOLTAGES MEASURED WITH REFERENCE TO CHASSIS
HF VÆRDIER MÅLT MED HF-PROBE STORNO NR 95,089
DC SPÆNDINGER MÅLT I FORHOLD TIL CHASSIS



L1-L14, L16
RED DOT
RØD PLET
BOTTOM VIEW
SET FRA BUNDEN



EXCITER
STYRESENDER

EX661

D400.778/3

Storno

TYPE	NO.	CODE	DATA	
C1	74. 5144	68 pF 2% ceram NO75 TB	250V	
C2	74. 5161	470 pF -20 +50% ceram II PL	63V	
C3	76. 5071	22 nF 10% polyester. FL	50V	
C4	76. 5072	47 nF 10% polyester. FL	50V	
C5	74. 5144	68 pF 2% ceram NO75 TB	250V	
C6	74. 5155	1 nF -20 +50% ceram II PL	63V	
C7	74. 5155	1 nF -20 +50% ceram II PL	63V	
C8	74. 5136	12 pF 5% ceram N150 DI	125V	
C9	74. 5135	10 pF 5% ceram N150 DI	125V	
C10	74. 5155	1 nF -20 +50% ceram II PL	63V	
C11	74. 5155	1 nF -20 +50% ceram II PL	63V	
C12	74. 5164	4. 7 nF -20 +50% ceram II PL	63V	
C13	74. 5144	68 pF 2% ceram NO75 TB	250V	
C14	74. 5013	100 pF 20% ceram II DI	500V	
C15	74. 5164	4. 7 nF -20 +50% ceram II PL	63V	
C16	74. 5163	2. 2nF -20 +50% ceram II PL	63V	
C17	76. 5072	47 nF 10% polyester. FL	50V	
C18	74. 5144	68 pF 2% ceram NO75 TB	250V	
C19	74. 5013	100 pF 20% ceram II DI	500V	
C20	74. 5164	4. 7 nF -20 +50% ceram II PL	63V	
C21	74. 5163	2. 2 nF -20 +50% ceram II PL	63V	
C22	74. 5111	56 pF 2% ceram NO75 TB	250V	
C23	74. 5125	1, 5 pF ± 0, 25pF ceram N150 BD	250V	
C24	74. 5144	68 pF 2% ceram NO75 TB	250V	
C25	74. 5106	22 pF ± 0, 5 pF ceram NO75 TB	250V	
C26	74. 5155	1 nF -20 +50% ceram II PL	63V	
C27	74. 5163	2, 2 nF -20 +50% ceram II PL	63V	
C28	74. 5107	27 pF ± 0, 5 pF ceram NO75 TB	250V	
C29	74. 5121	0, 68pF ± 0, 1pF ceram P100 BD	250V	
C30	74. 5106	22 pF ± 0, 5 pF ceram NO75 TB	250V	
C31	74. 5106	22 pF ± 0, 5 pF ceram NO75 TB	250V	
C32	74. 5155	1 nF -20 +50% ceram II PL	63V	
C33	74. 5163	2, 2 nF -20 +50% ceram II PL	63V	
C34	74. 5134	8, 2pF ± 0, 25pF ceram N150 DI	250V	
C35	74. 5144	68 pF 2% ceram NO75 TB	250V	
C36	74. 5133	6, 8 pF ± 0, 25pF ceram N150 DI	250V	
C37	78. 5026	4, 5/20pF ceram trimmer N750 DI	100V	
C38	74. 5155	1 nF -20 +50% ceram II PL	63V	
C39	76. 5072	47 nF 10% polyester. FL	50V	
C40	74. 5129	3, 3 pF ± 0, 25 pF ceram N150 DI	250V	
C41	74. 5134	8, 2 pF ± 0, 25 pF ceram N150 DI	250V	
C42	78. 5026	4, 5/20pF ceram N750 DI	100V	
C43	74. 5155	1 nF -20 +50% ceram II PL	63V	
C44	76. 5044	0, 22 μF 10% polyester. FL	50V	
C45	76. 5072	47 nF 10% polyester. TB	100V	
C46	74. 5132	5, 6 pF ± 0, 25 pF ceram N150 DI	250V	
C47	74. 5116	33 pF 2% ceram NO75 TB	250V	
C48	78. 5030	10/60 pF trimmer N150 DI	250V	

Storno

TYPE	NO.	CODE	DATA	
C49	76. 5072	47 nF 10% polyester. FL	50V	
C50	73. 5114	1 μF 20% tantal		
C51	74. 5155	1 nF -20 +50% ceram II PL	63V	
R2	80. 5253	2, 2 kΩ 5% carbon film	1/8W	
R3	80. 5257	4, 7 kΩ 5% carbon film	1/8W	
R4	80. 5256	3, 9 kΩ 5% carbon film	1/8W	
R5	80. 5255	3, 3 kΩ 5% carbon film	1/8W	
R6	80. 5057	4, 7 kΩ 5% carbon film	0, 1W	
R7	80. 5239	150 Ω 5% carbon film	1/8W	
R8	80. 5239	2, 7 kΩ 5% carbon film	1/8W	
R9	80. 5239	150 Ω 5% carbon film	1/8W	
R10	80. 5060	8, 2 kΩ 5% carbon film	0, 1W	
R11	80. 5257	4, 7 kΩ 5% carbon film	1/8W	
R12	80. 5249	1 kΩ 5% carbon film	1/8W	
R13	80. 5259	6, 8 kΩ 5% carbon film	1/8W	
R14	80. 5258	5, 6 kΩ 5% carbon film	1/8W	
R15	80. 5259	6, 8 kΩ 5% carbon film	1/8W	
R16	89. 5010	15 kΩ 20% NTC	0. 6W	
R17	80. 5266	27 kΩ 5% carbon film	1/8W	
R18	80. 5239	150 Ω 5% carbon film	1/8W	
R19	80. 5254	2, 7 kΩ 5% carbon film	1/8W	
R20	80. 5239	150 Ω 5% carbon film	1/8W	
R21	80. 5057	4, 7 kΩ 5% carbon film	0. 1W	
R22	80. 5258	5, 6 kΩ 5% carbon film	1/8W	
R23	80. 5260	8, 2 kΩ 5% carbon film	1/8W	
R24	80. 5257	4, 7 kΩ 5% carbon film	1/8W	
R25	80. 5259	6, 8 kΩ 5% carbon film	1/8W	
R26	80. 5060	8, 2 kΩ 5% carbon film	0, 1W	
R27	80. 5258	5, 6 kΩ 5% carbon film	1/8W	
R28	80. 5255	3, 3 kΩ 5% carbon film	1/8W	
R29	80. 5245	470 Ω 5% carbon film	1/8W	
R30	80. 5253	2, 2 kΩ 5% carbon film	1/8W	
R31	80. 5061	10 kΩ 5% carbon film	0, 1W	
R32	80. 5061	10 kΩ 5% carbon film	0, 1W	
R33	80. 5256	3, 9 kΩ 5% carbon film	1/8W	
R34	80. 5254	2, 7 kΩ 5% carbon film	1/8W	
R35	80. 5246	560 Ω 5% carbon film	1/8W	
R36	80. 5251	1, 5 kΩ 5% carbon film	1/8W	
R37	80. 5255	3, 3 kΩ 5% carbon film	1/8W	
R38	80. 5255	3, 3 kΩ 5% carbon film	1/8W	
R39	80. 5255	3, 3 kΩ 5% carbon film	1/8W	
R40	80. 5245	470 Ω 5% carbon film	1/8W	

**EXCITER
STYRESENDER**

EX661

X400. 779/3

Storno

Storno

TYPE	NO.	CODE	DATA
	R41	80. 5249	1 k Ω 5% carbon film
	R42	80. 5261	10 k Ω 5% carbon film
	R43	80. 5245	470 Ω 5% carbon film
	R44	80. 5247	680 Ω 5% carbon film
	R45	80. 5237	100 Ω 5% carbon film
	R46	80. 5221	4, 7 Ω 10% carbon film
	R47	80. 5059	6, 8 k Ω 5% carbon film
	R48	80. 5056	3, 9 k Ω 5% carbon film
	L1	61. 945	Coil/spole 12, 16-14, 15 MHz (C1)
	L2	61. 946	Coil/spole 12, 16-14, 15 MHz (C5-R6)
	L3	61. 827-01	Coil/spole 12, 16-14, 5 MHz (C7-R10-E2)
	L4	61. 828-01	Coil/spole 12, 16-14, 5 MHz (C8-C9)
	L5	61. 829-01	Coil/spole 12, 16-14, 5 MHz (C10-E3)
	L6	61. 947	Coil/spole 12, 16-14, 5 MHz (C13-C14-R21)
	L7	61. 948	Coil/spole 12, 16-14, 5 MHz (C18-R26)
	L8	61. 949	Coil/spole 24, 33-29 MHz (C22-R31)
	L9	61. 950	Coil/spole 24, 33-29 MHz (C24-R32)
	L10	61. 951	Coil/spole 73-87 MHz (C28)
	L11	61. 851-01	Coil/spole 73-87 MHz (C30)
	L12	61. 952	Coil/spole 146-174 MHz (C34)
	L13	61. 953	Coil/spole 146-174 MHz (C36)
	L14	61. 854-01	Coil/spole 146-174 MHz (C41)
	L15	62. 721	Coil/spole 146-174 MHz
	L16	61. 856-01	Coil/spole 146-174 MHz
	L17	61. 5007	15 μ H 20% filtercoil/drossel 200 mA
	L18	63. 5008	0, 47 μ H 20% filtercoil/drossel 2, 2A
	E1	99. 5136	Diode AA119
	E2	99. 5140	Capacitance diode BA101C
	E3	99. 5140	Capacitance diode BA101C
	Q1	99. 5118	Transistor BF115
	Q2	99. 5118	Transistor BF115
	Q3	99. 5139	Transistor BSX19
	Q4	99. 5139	Transistor BSX19
	Q5	99. 5139	Transistor BSX19
	Q6	99. 5139	Transistor BSX19
	Q7	99. 5138	Transistor 2N3866
	FC	65. 5061	Ferroxcube beads/ferritperler 60 MHz

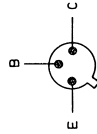
TYPE	NO.	CODE	DATA

EXCITER
STYRESENDER

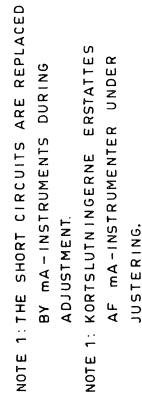
EX661

X400.779/3

DRIVER



PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE
TRYKT KREDSLØB SET FRA KOMPONENTSIDEN



PA661

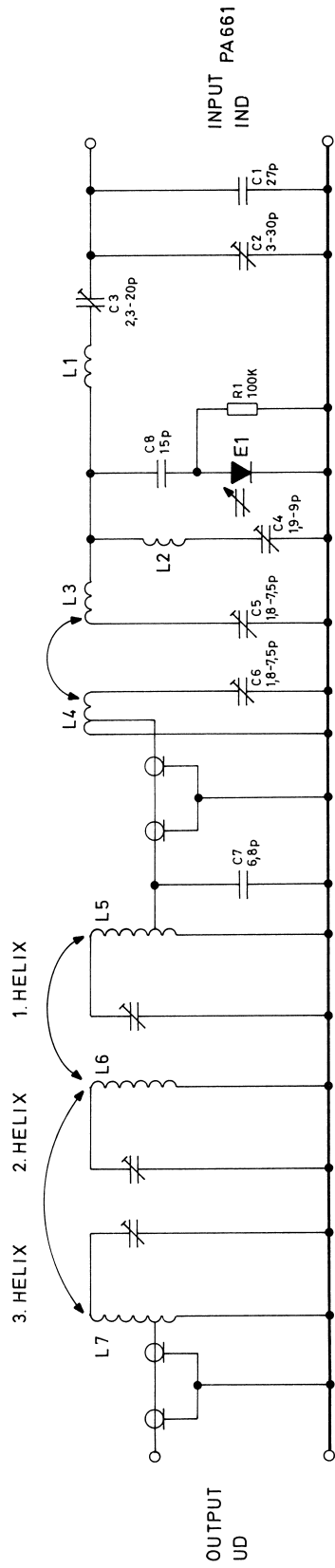
TYPE	NO.	CODE	DATA
	C1	78.5029	3/30 pF trimmer P40 norm.
	C2	78.5029	3/30 pF trimmer P40 norm.
	C3	74.5138	18 pF 5% ceram N150
	C4	74.5166	470 pF -20+50% ceram II PL
	C5	74.5155	1 nF -20+50% ceram II PL
	C6	76.5072	47 nF 10% polyester, FL
	C7	74.5155	1 nF -20+50% ceram II PL
	C8	73.5100	10 μ F -10+100% elco TB
	C9	78.5029	3/30 pF trimmer P40 norm.
	C10	78.5029	3/30 pF trimmer P40 norm.
	C11	74.5138	18 pF 5% ceram N150
	C12	74.5161	470 pF -20+50% ceram II PL
	C13	74.5155	1 nF -20+50% ceram II PL
	C14	76.5072	47 nF 10% polyester, FL
	C15	74.5155	1 nF -20+50% ceram II PL
	C16	73.5100	10 μ F -10+100% elco TB
	C17	78.5029	3/30 pF trimmer P40 norm.
	C18	78.5029	3/30 pF trimmer P40 norm.
	C19	74.5155	1 nF -20+50% ceram II PL
	C20	74.5155	1 nF -20+50% ceram II PL
	C21	74.5135	10 pF 5% ceram N150 DI
	C22	74.5130	3, 9 pF 0, 25% ceram N150 DI
	C23	74.5135	10 pF 5% ceram N150 DI
	R1	89.5031	1 Ω 10% oxid
	R2	80.5225	10 Ω 5% carbon film
	R3	89.5031	1 Ω 10% oxid
	R4	80.5225	10 Ω 10% carbon film
	R5	86.5042	500 Ω 20% potm. Lin. carb. film
	R6	80.5243	330 Ω 5% carbon film
	R7	80.5253	2, 2 k Ω 5% carbon film
	R8	80.5433	47 Ω 5% carbon film
	R9	80.5433	47 Ω 5% carbon film
	L1	62.718	RF-coil/HF-spole 140-156 MHz
	L3	63.5006	2, 2 μ H 20% filter coil/drossel
	L4	63.5008	0, 47 μ H 20% filter coil/drossel
	L5	62.719	RF-coil/HF-spole 140-156 MHz
	L6	62.718	RF-coil/HF-spole 140-156 MHz
	L7	63.5008	0, 47 μ H 20% filter coil/drossel
	L8	63.5008	0, 47 μ H 20% filter coil/drossel
	L9	63.5006	2, 2 μ H 20% filter coil/drossel
	L10	62.717	RF-coil/HF-spole 140-156 MHz
	L11	62.716	RF-coil/HF-spole 140-156 MHz
	E1	99.5028	Diode OA200
	E2	99.5114	Zenerdiode BZY57

TYPE	NO.	CODE	DATA
	Q1	99.5129	Transistor 2N3553
	Q2	99.5137	Transistor 2N3632
	Q3	99.5121	Transistor BC107
	FC	65.5061	Ferrox cube beads/ferritperler 60 MHz

RF-POWER AMPLIFIER
HF-EFFEKT FORSTÆRKER

PA661

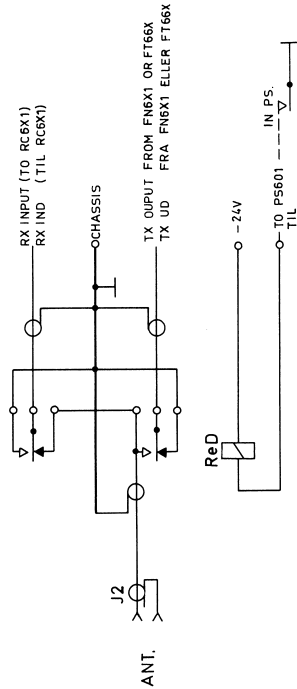
X400.784



FREQUENCY TRIPLER
FREKVENSTRIPLER

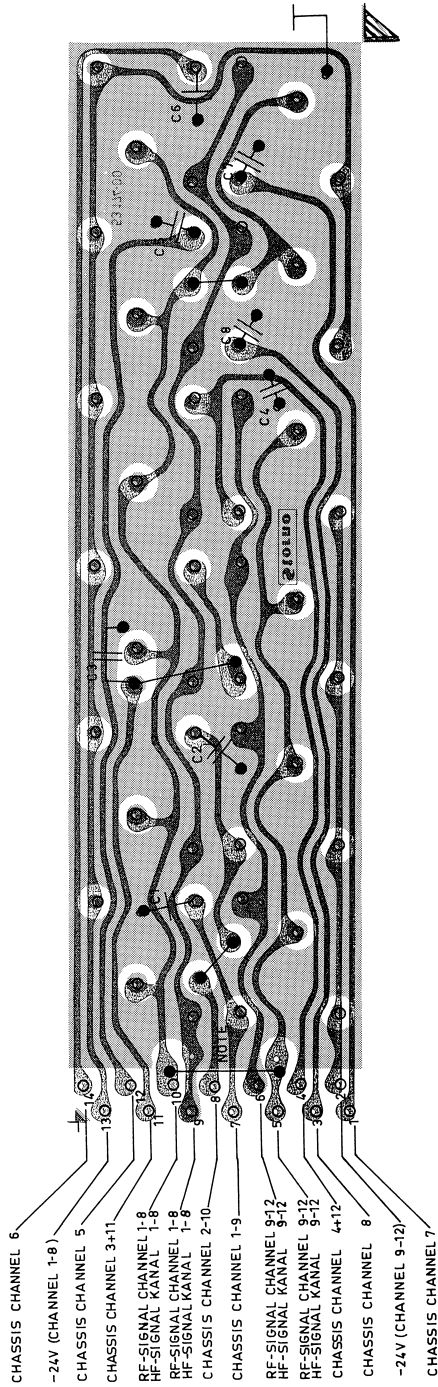
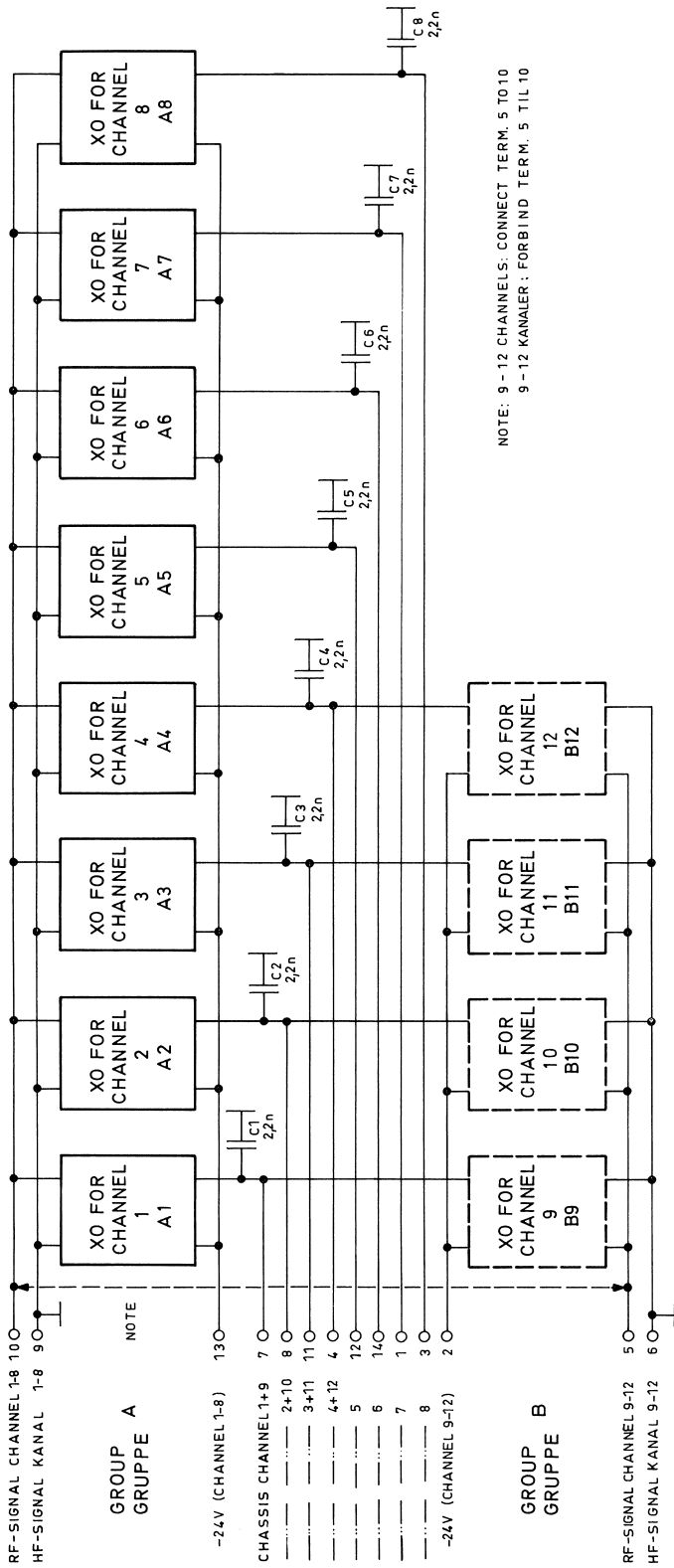
FT662

D401.026



AS631a	58.5063	RELAY	RELÆ	24V	730a	21-21
ReD						
AS661	58.5063	RELAY	RELÆ	24V	730a	21-21
ReD						

ANTENNA SHIFT UNIT AS631a AS661
ANTENNE SKIFTEENHED



Storno

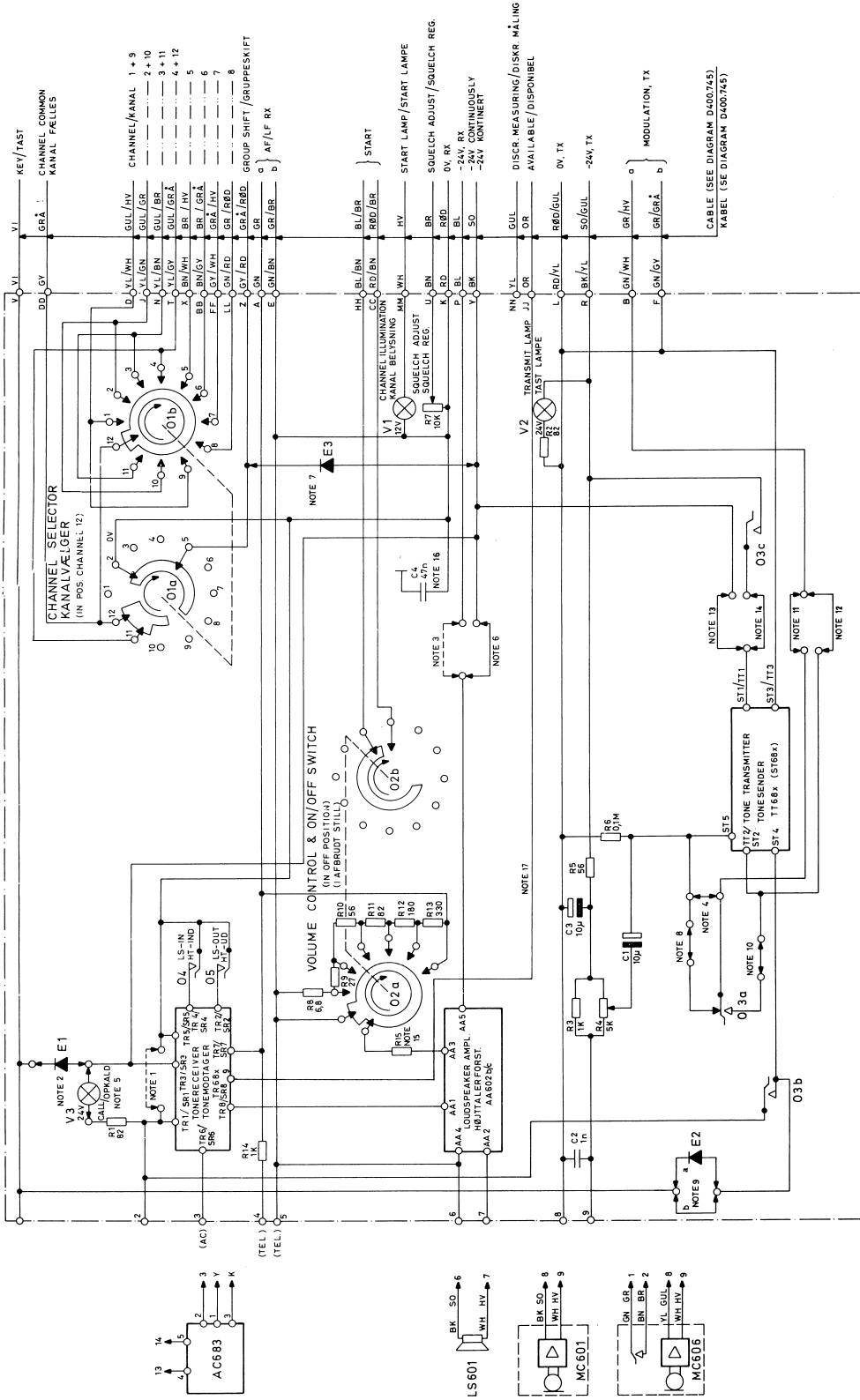
TYPE	NO.	CODE	DATA
	C1	76.5059	2.2 nF 10% polyester. FL 50V
	C2	76.5059	2.2 nF 10% " FL 50V
	C3	76.5059	2.2 nF 10% " FL 50V
	C4	76.5059	2.2 nF 10% " FL 50V
	C5	76.5059	2.2 nF 10% " FL 50V
	C6	76.5059	2.2 nF 10% " FL 50V
	C7	76.5059	2.2 nF 10% " FL 50V
	C8	76.5059	2.2 nF 10% " FL 50V

Storno

TYPE	NO.	CODE	DATA

CRYSTAL OSCILLATOR PANEL XS601

X400.875



- Note 1: Strap in CB without Tone Receiver TR680, SR680, or SR6841
Strappes i CB uden tonemodtager TR680, SR680 eller SR6841
- Note 2: Diode, Code No. 99.5020 is inserted in CB with tone Receiver TR680, SR680, or SR6841
Diode, Kode nr. 99.5020 sættes i CB med tonemodtager TR680, SR680 eller SR6841
- Note 3: Strap in CB without Tone Receiver and in CB for Duplex Operation
Strappes i CB uden tonemodtager og i CB for duplex drift
- Note 4: Strap in CB without Tone Transmitter TT680 or ST680
Strappes i CB uden tonesender TT680 eller ST680
- Note 5: Socket and Lamp V3 is inserted in CB with Tone Receiver TR680, SR680, or SR6841
Framing og lampe V3 monteres i CB med tonemodtager TR680, SR680 eller SR6841
- Note 6: Strap in CB with Tone Receiver TR680, SR680, or SR6841
Strappes i CB med tonemodtager TR680, SR680 eller SR6841 og i CB for simplex drift.

- Note 7: Diode, Code No. 99.5020 is inserted in CB with 9-12 channels and with TR680, SR680, or SR6841
Diode, Kode Nr. 99.5020 sættes i CB med 9-12 kanaler og med TR680, SR680 eller SR6841
- Note 8: Strap in CB with TT680
Strappes i CB med TT680
- Note 9: a) Diode (Code No. 99.5020) is inserted in CB with ST680 if Transmit Button 03 is used for Tone Calling and External Transmit Button is used for Transmitting.
b) A Strap is inserted in CB with TT680 and in CB with TT680 for identification and in CB without Tone Equipment Transmitter.
a) Diode (Kode nr. 99.5020) sættes i CB med ST680, hvis tast 03 bruges til tonesending og udvendig tast b) Strappes i CB med TT680 og i CB med ST680 anvendt til identifikation samt i CB uden tonesender
- Note 10: Strap in CB with TT680
Strappes i CB med TT680

- Note 11: Remove strap in CB with ST680
Fjern strapping i CB med ST680
- Note 12: Strap in CB with ST680
Strappes i CB med ST680
- Note 13: Strap in CB with ST680
Strappes i CB med ST680
- Note 14: Strap in CB with TT680
Strappes i CB med TT680

Input Sensitivity for 2W	+3dBm	0dBm	-3dBm	-9dBm
R15	22 kΩ	12 kΩ	6,8 kΩ	2,7 kΩ

- Note 15: Indgangsfølsomhed for 2W
- Note 16: Capacitor C4 (47 pF - Code No. 76.5072) is inserted in CB with Tone Equipment
Kondensator C4 (Kode nr. 76.5072) sættes i CB med tonensstyr
- Note 17: Connection with Tone Receiver SR6841 only
Forbindelse kun med tonemodtager SR6841

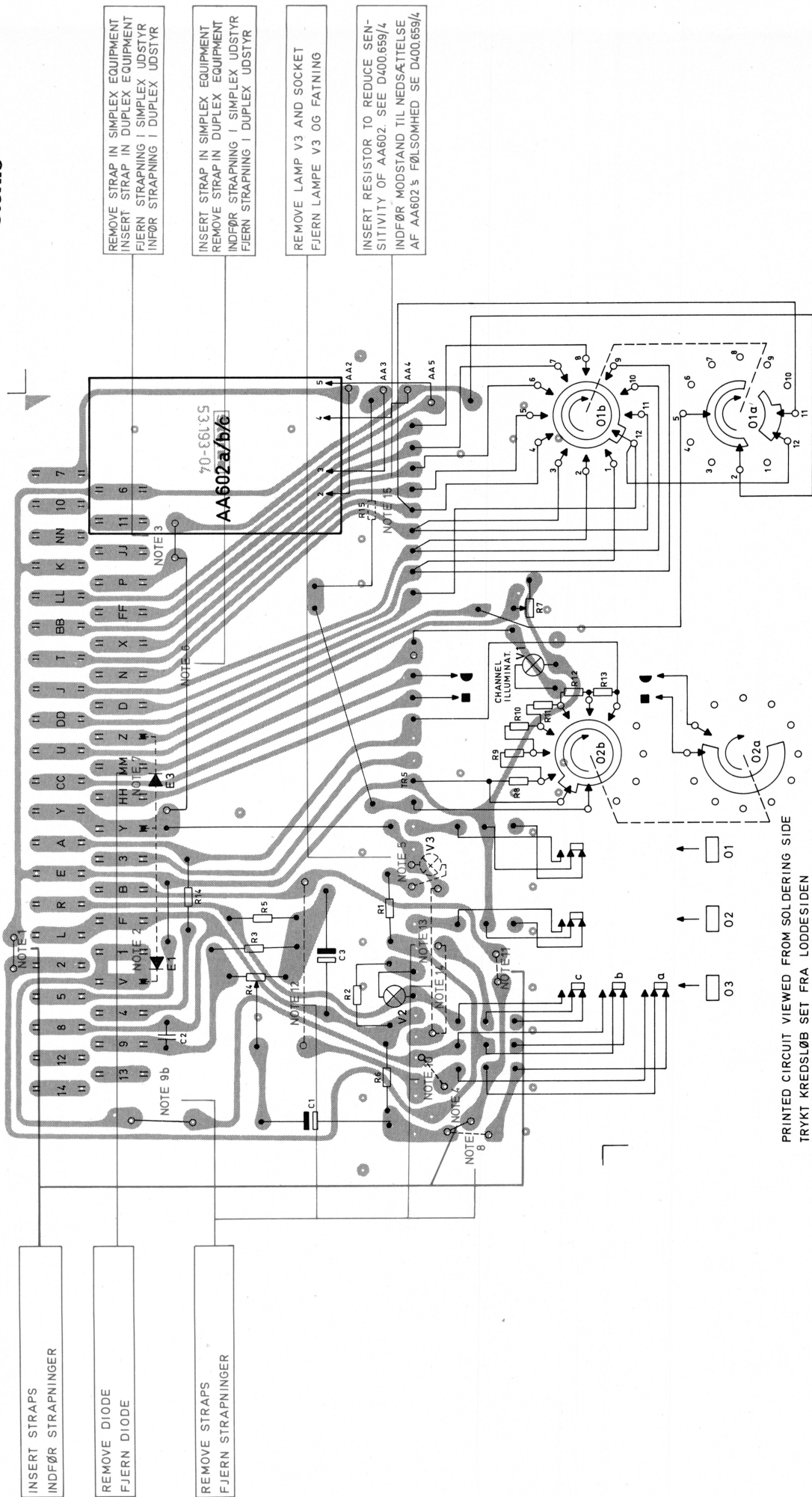
CONTROL BOX MANØVRE BOKS

CB601b

D400.659/5

Storno

Storno



CONTROL BOX CB601b WITHOUT TONE EQUIPMENT
KONTROL BOKS CB601b UDEN TONEUDSTYR

D400.761/2

Storno

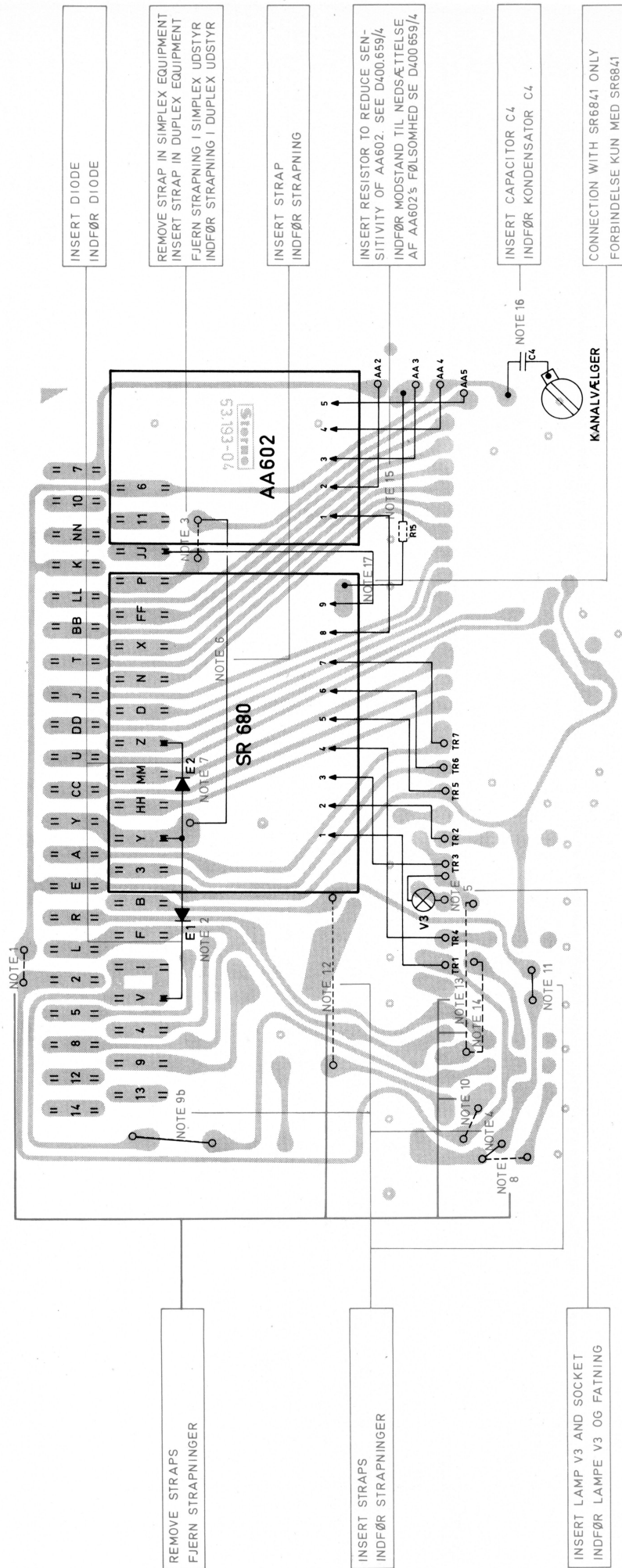


INSTALLATION OF TT680 IN CB601b
INDBYGNING AF TT680 I CB601b

D400.945

Storno

Storno



INSTALLATION OF TR680, SR680, OR SR6841 IN CB601b
INDBYGNING AF TR680, SR680 ELLER SR6841 I CB601b

D400.946/2

Sorno

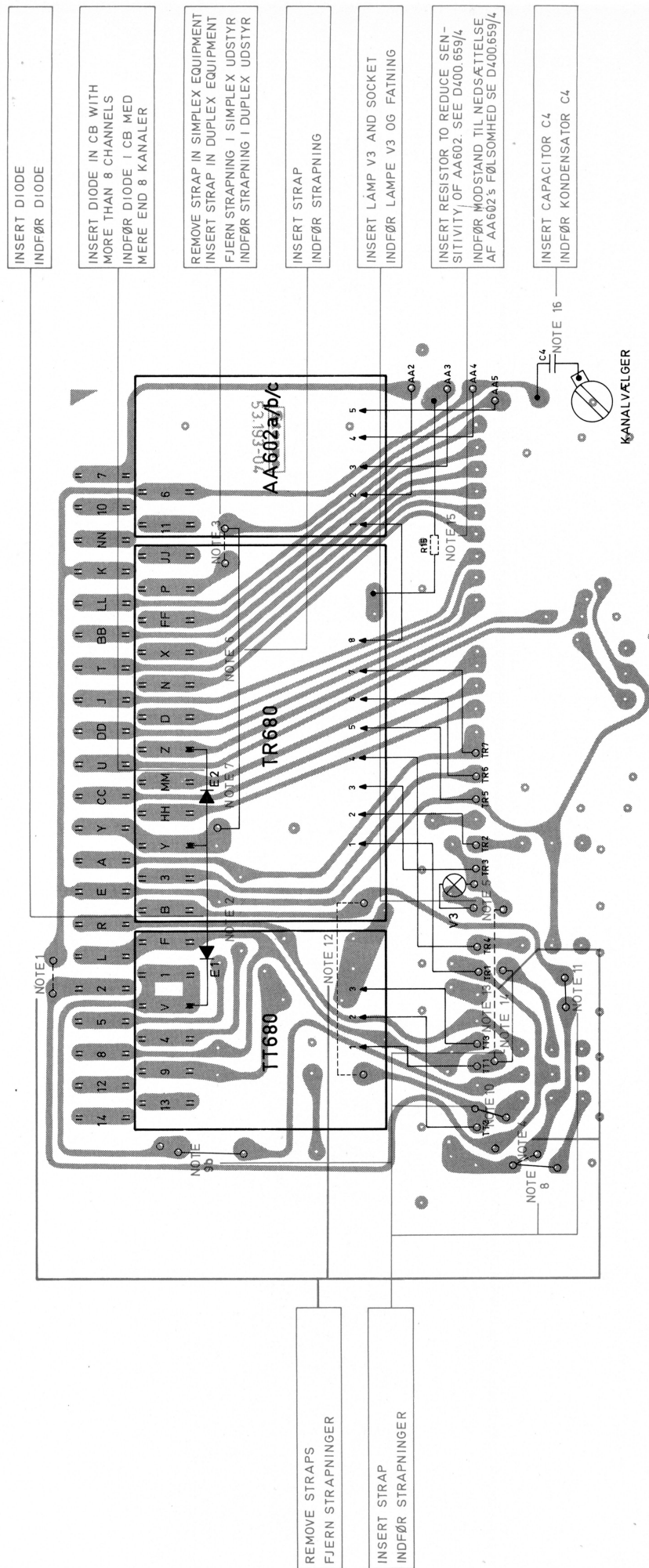


INSTALLATION OF ST680 IN CB601b
INDBYGNING AF ST680 I CB601b

D400.947

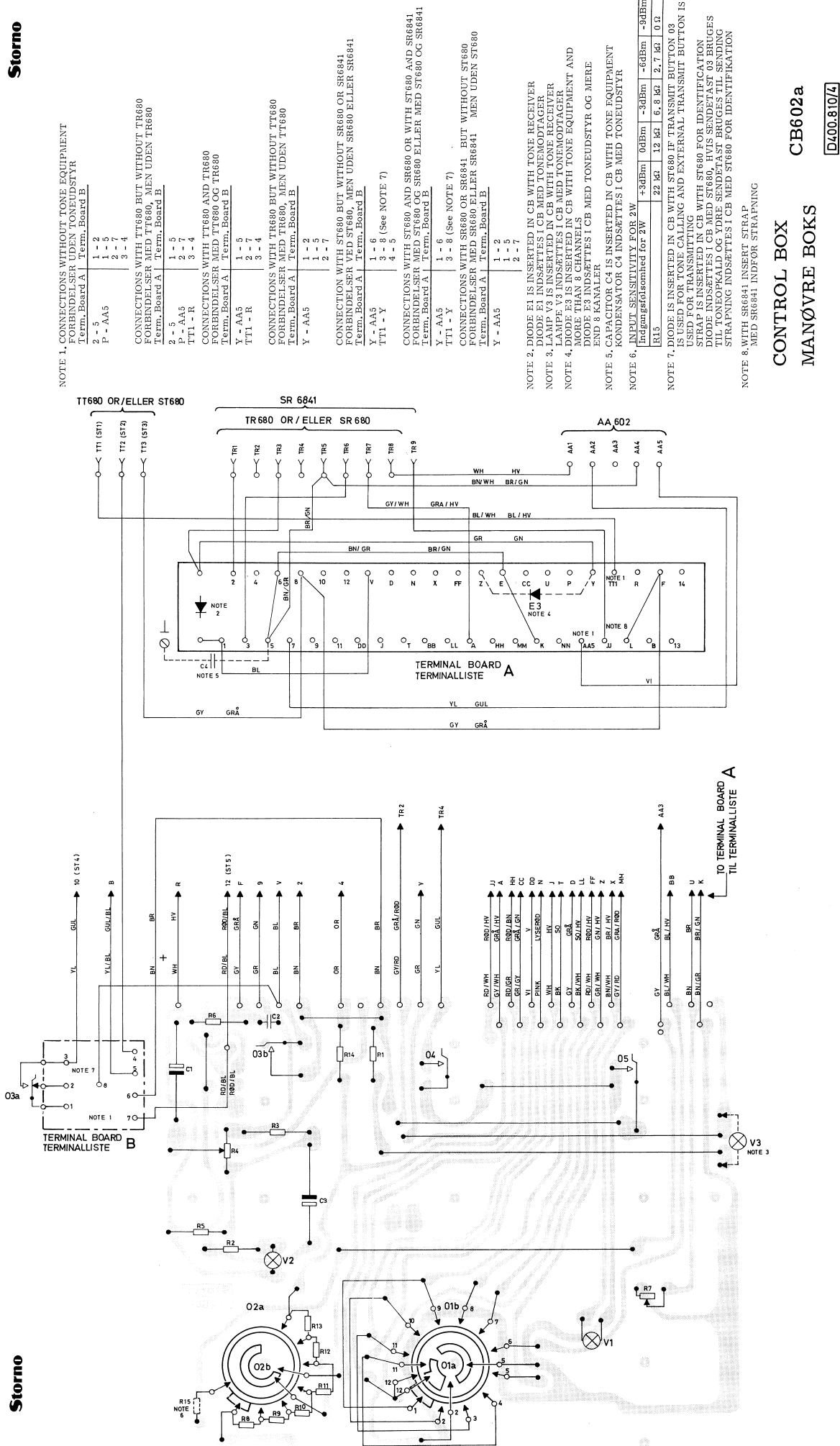
Sorno

Sorno



INSTALLATION OF TR680 AND TT680 IN CB601b
INDBYGNING AF TR680 OG TT680 I CB601b

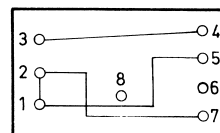
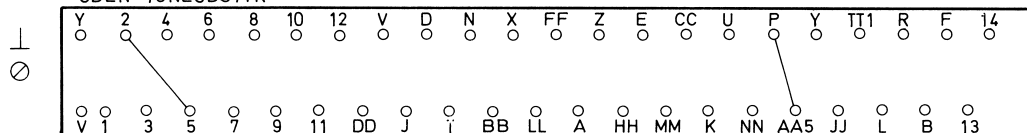
D400.972



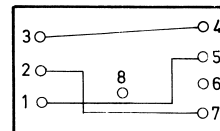
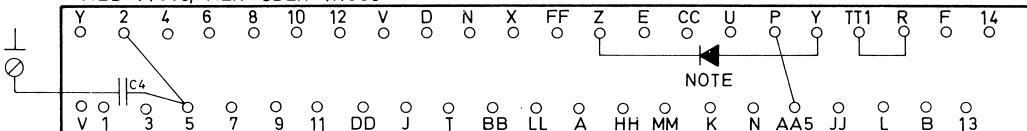
TERMINAL BOARD TERMINALLISTE A

TERMINAL BOARD TERMINALLISTE B

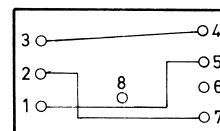
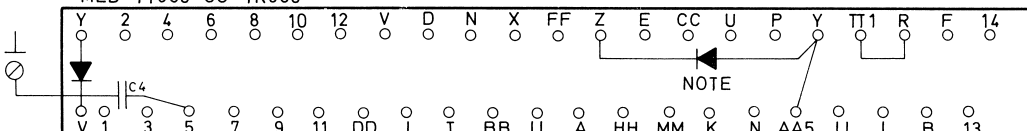
1. WITHOUT TONE EQUIPMENT
UDEN TONEUDSTYR



2. WITH TT680, BUT WITHOUT TR680
MED TT680, MEN UDEN TR680

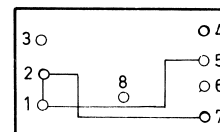
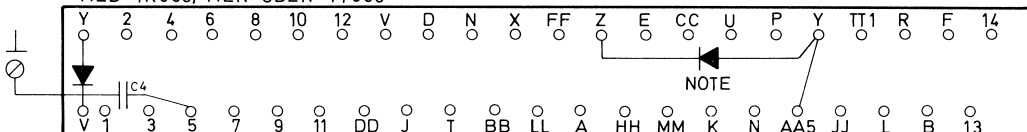


3. WITH TT680 AND TR680
MED TT680 OG TR680



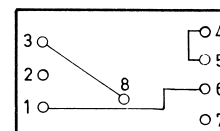
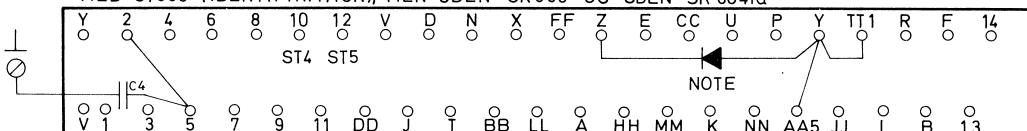
V3
INSERTED
ISÆTTES

4. WITH TR680, BUT WITHOUT TT680
MED TR680, MEN UDEN TT680

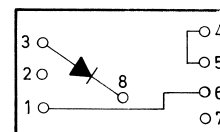
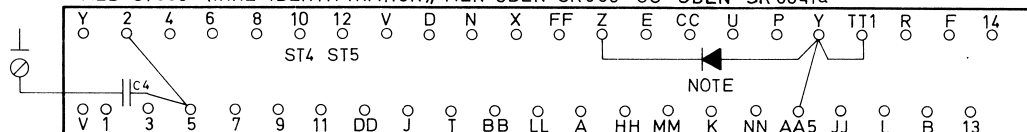


V3
INSERTED
ISÆTTES

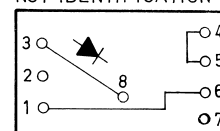
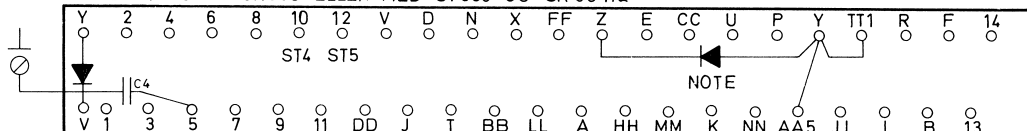
5. WITH ST680 (IDENTIFICATION), BUT WITHOUT SR680 OR SR 6841a
MED ST680 (IDENTIFIKATION), MEN UDEN SR680 OG UDEN SR 6841a



6. WITH ST680 (NOT IDENTIFICATION), BUT WITHOUT SR680 AND SR 6841a
MED ST680 (IKKE IDENTIFIKATION), MEN UDEN SR680 OG UDEN SR 6841a



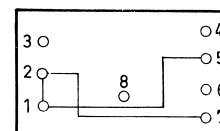
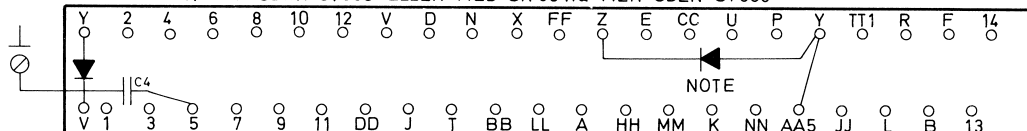
7. WITH ST680 AND SR680 OR ST680 AND SR 6841a
MED ST680 OG SR680 ELLER MED ST680 OG SR 6841a



IDENTIFICATION SEE 5.
NOT IDENTIFICATION SEE 6.

V3
INSERTED
ISÆTTES

8. WITH SR680, BUT WITHOUT ST680 OR WITH SR 6841a BUT WITHOUT ST680
MED SR680, MEN UDEN ST680 ELLER MED SR 6841a MEN UDEN ST680

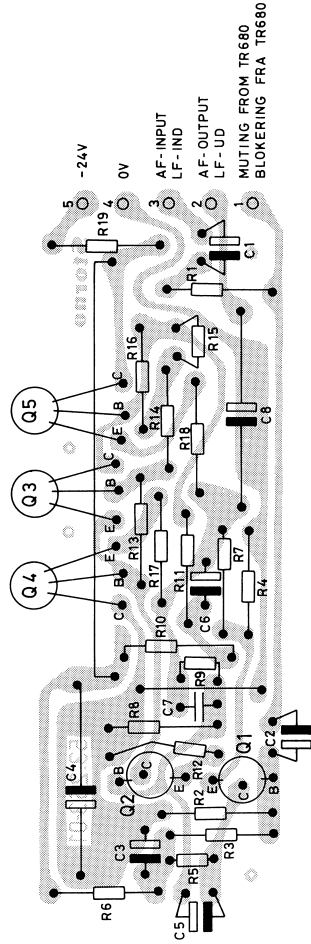
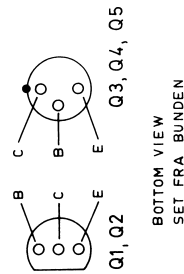
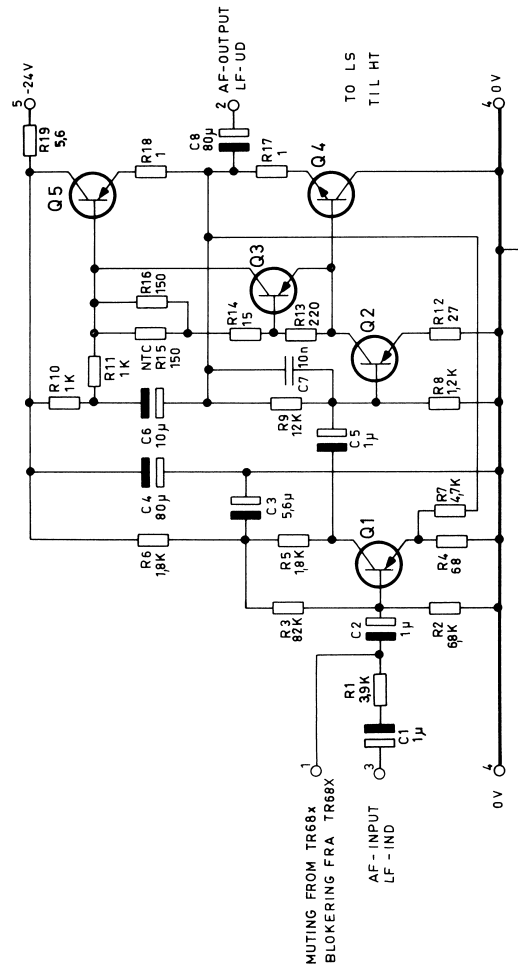


V3
INSERTED
ISÆTTES

NOTE

DIODE IS INSERTED IN EQUIPMENT WITH TONE UNITS AND MORE THAN 8 CHANNELS
DIODE INDÆTTES I UDSTYR MED TONEHEDER OG MERE END 8 KANALER

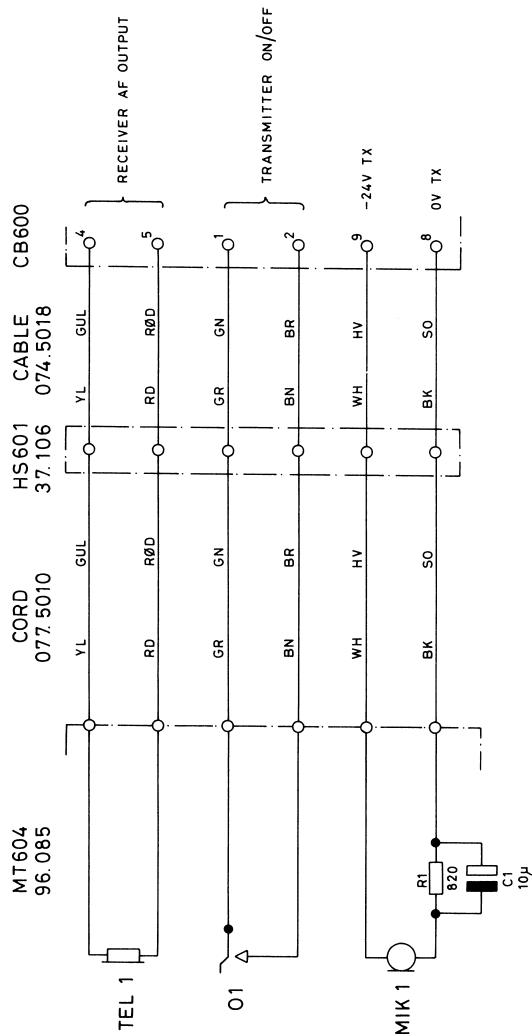
INSTALLATION OF TONE EQUIPMENT IN CB602a
INDBYGNING AF TONEUDSTYR I CB602a



AF-AMPLIFIER
LF-FORSTÆRKER

AA602c

D400.836/3



Storno

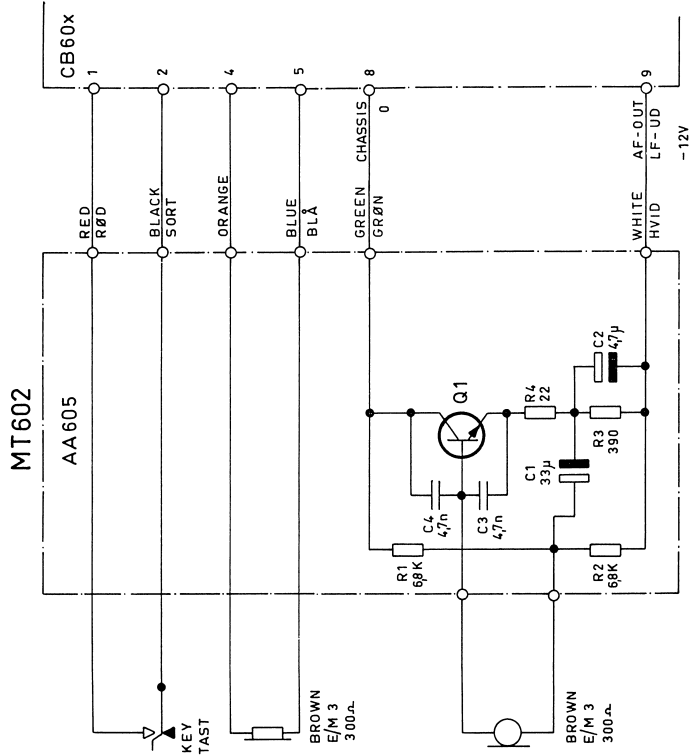
TYPE	NO.	CODE	DATA
MT601			Handset (Comprising MT604 and HS601) Mikrotelefon (omfattende MT604 og HS601)
MT604		96.085	Handset
HS601		37.106	Handset retainer
	C1	73.5109	10 μ F 20% tantal 15V
	R1	80.5248	820 Ω 5% carbon film 1/8W
	O1	47.5039	Microswitch
	MIK1	96.5074	Microphone, dyn. 1500 Ω
	TEL1	96.5073	Receiver, dyn. 300 Ω

Storno

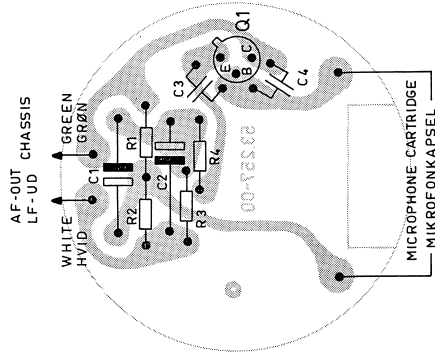
TYPE	NO.	CODE	DATA

HANDSET MT601

X401.225



PRINTED CIRCUIT SEEN FROM COMPONENT SIDE
TRYKT KREDSLØB SET FRA KOMPONENTSIDEN



MICROTELEPHONE
MIKROTELEFON

MT602

D400.744/3

Storno

TYPE	NO.	CODE	DATA
		96.5008 96.5006 10.1506	Microphone handset Microphone cartridge AA605 Amplifier/Forstærker
			<u>AA605</u>
	C1	73.5053	33 μ F -20/+50% Tantal 6 V
	C2	73.5080	4.7 μ F 20% Tantal 10 V
	C3	74.5108	4.7 nF -20/+80% 20 V
	C4	74.5108	4.7 nF -20/+80% 20 V
	R1	80.5059	6.8 k Ω 5% carbon film 1/10 W
	R2	80.5059	6.8 k Ω 5% " " 1/10 W
	R3	80.5044	390 Ω 5% " " 1/10 W
	R4	80.5029	22 Ω 5% " " 1/10 W
	Q1	99.5143	Transistor BC108

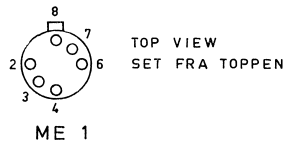
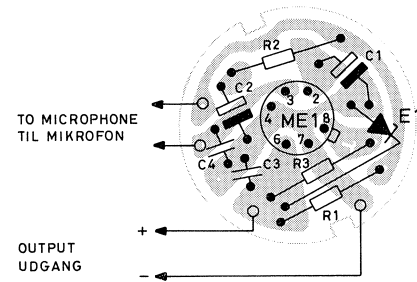
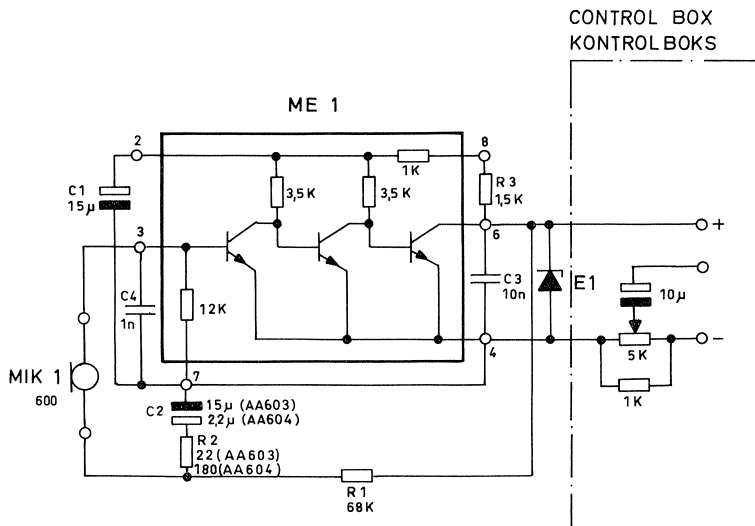
Storno

TYPE	NO.	CODE	DATA

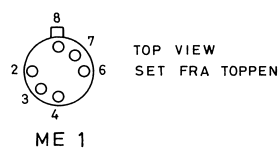
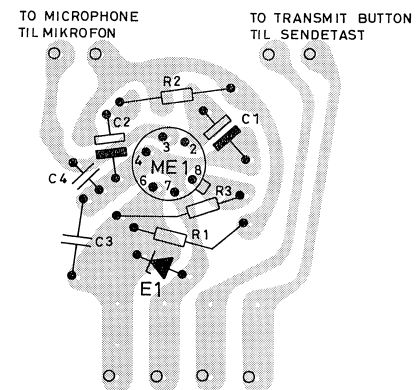
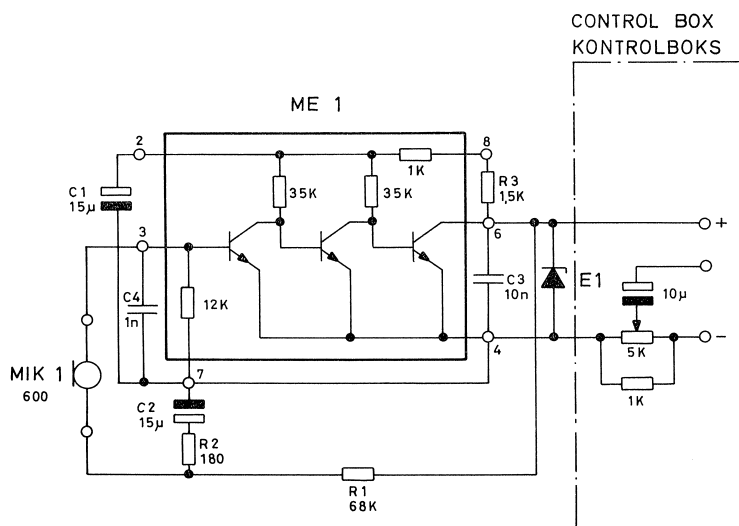
MICROTELEPHONE
MIKROTELEFON

MT602

X400.869



AA603, AA604



AA606

AF-AMPLIFIER
LF-FORSTÆRKER

AA603, AA604, AA606

Storno

TYPE	NO.	CODE	DATA
AA603	C1	73. 5105	15 μ F 20% tantal 15V
AA604	C2	73. 5105	15 μ F 20% tantal 15V
AA606	C2	73. 5102	2. 2 μ F 20% tantal 35V
	C2	73. 5105	15 μ F 20% tantal 15V
	C3	76. 5070	1 nF 10% polyester FL 50V
	R1	80. 5271	68 k Ω 5% carbon film 1/8W
AA603	R2	80. 5229	22 Ω 5% " 1/8W
AA604	R2	80. 5240	180 Ω 5% " 1/8W
AA606	R2	80. 5240	180 Ω 5% " 1/8W
	R3	80. 5251	1. 5 k Ω 5% " 1/8W
	E1	99. 5042	Zenerdiode 9, 1V 5%
	ME1	14. 5001	LF-forstærker 65 dB 40mW AF-Amplifier

Storno

TYPE	NO.	CODE	DATA

AF-AMPLIFIER

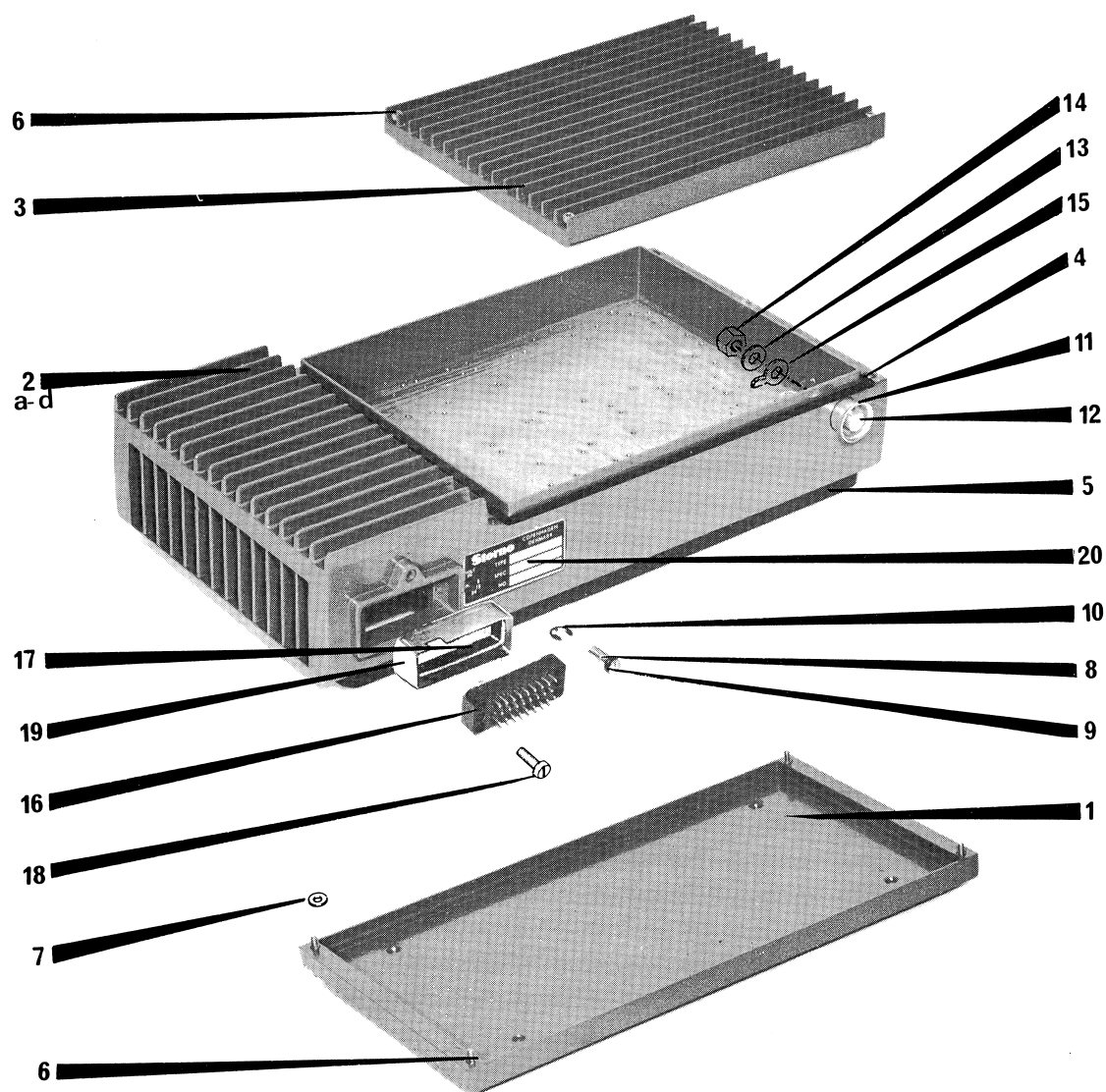
AA603, AA604, AA606

LF-FORSTÆRKER

X400. 909

CHAPTER VII. MECHANICAL PARTS LISTS

When ordering mechanical parts from Storno please state the code numbers and descriptions given in the parts lists.

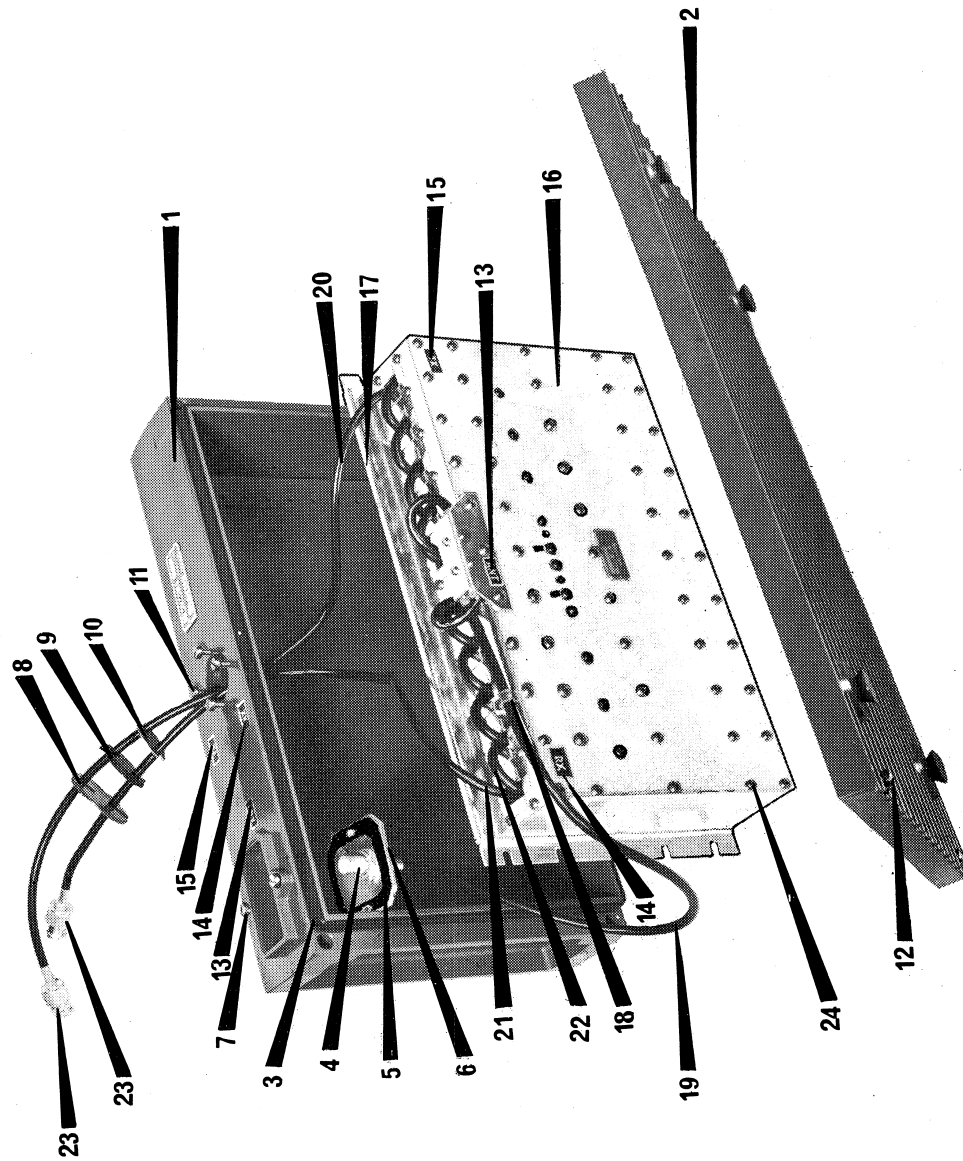


CABINET FOR CQM600
GEHÄUSE FÜR SQM600

M405.012

ITEM	CODE	DESCRIPTION
	10.1157	Cabinet CA601 for CQM610 and CQM630 with one hole for antenna connector
	10.1555	Cabinet CA608 for CQM610 and CQM630 with two holes for antenna connectors
	10.2111	Cabinet CA6014 for CQM660 with one hole for antenna connector
	10.2112	Cabinet CA6015 for CQM660 with two holes for antenna connectors
1	12.059-00	Base plate Bundplade
2a	12.057-00	Intermediate cabinet section for CA601 Kabinet mellemplade til CA601
2b	12.103	Intermediate cabinet section for CA608 Kabinet mellemplade til CA608
2c	12.134	Intermediate cabinet section for CA6014 Kabinet mellemplade til CA6014
2d	12.135	Intermediate cabinet section for CA6015 Kabinet mellemplade til CA6015
3	12.058-00	Lid Låg
4	32.149	Gasket Pakning
5	32.150	Gasket Pakning
6	20.033-040.15	Screw Skrue
7	36.124	Lock-ring Låsering
8	55.017-01	Extension piece for voltage switch Omskifteraksel
9	32.5018	Gasket Pakning
10	24.45-110.050	Lock-ring Låsering
11	38.042	Connector collar Konnektorbrønd
12	41.150-01	Antenna connector Antenne konnektor
13	32.160	Gasket Pakning
14	29.180	Nut Møtrik
15	34.038	Soldering lug Loddeflig
16	41.5081	34-way connector, male 34-polet konnektor, han
17	32.194	Gasket Pakning
18	20.022-026.06	Screw M2.6 x 6 Skrue M2,6 x 6
19	13.031	Code screen Kodeskærm
20	51.362	Type plate Typeskilt

CABINET FOR CQM600
KABINET FOR CQM600



BRANCHING FILTER
ANTENNENWEICHE

BF661a, BF662b

ITEM	CODE	DESCRIPTION
	90.214-21	Branching Filter Type BF662b Dupleksfilter BF662b komplet
1-15	10.2042	Cabinet CA6012 Kabinet CA6012 komplet
1	12.126	Cabinet Cover Kabinet
2	12.119	Cabinet Base Bund
3	32.150	Gasket Gummipakning
4	41.5149	Connector BNC, Female BNC konnektor (hun)
5	32.256	Gasket Pakning
6	11.642	Connector Bracket Holder for konnektor
7	20.011-040.40	Screw M4 x 40 Skrue M4 x 40
8	11.644	Cover Plate Dæksel
9	32.257	Packing Pakning
10	11.643	Plate Plade
11	20.011-040.08	Screw M4 x 8 Skrue M4 x 8
12	20.033-040.15	Screw M4 x 15 Skrue M4 x 15
13	51.498	Antenna Label Antenne-skilt
14	51.496	RX Label RX-skilt
15	51.495	TX Label TX-skilt
13-24	90.213-01	Branching Filter Type BF661a Dupleksfilter BF661a komplet
13	51.498	Antenna Label Antenne-skilt
14	51.496	RX Label RX-skilt
15	51.495	TX Label TX-skilt
16	11.725	Chassis Chassis
17	11.726	Cover Låg
18	38.5017	Cable Clamp Kabelbøjle
19	19.091	Antenna Cable Antennekabel
20	19.093	TX Cable and Connector TX-kabel med konnektor
21	19.092	RX Cable and Connector RX-kabel med konnektor

BRANCHING FILTER DUPEKSFILTER

BF661a, BF662b

Storno**Storno**

ITEM	CODE	DESCRIPTION
22	19.094	Inter Connecting Cable Mellemkabel
23	41.5148	Connector BNC, Male BNC konnektor, (han)
24	20.412-029.07	Screw BZ2.9 x 7 Skrue BZ2.9 x 7

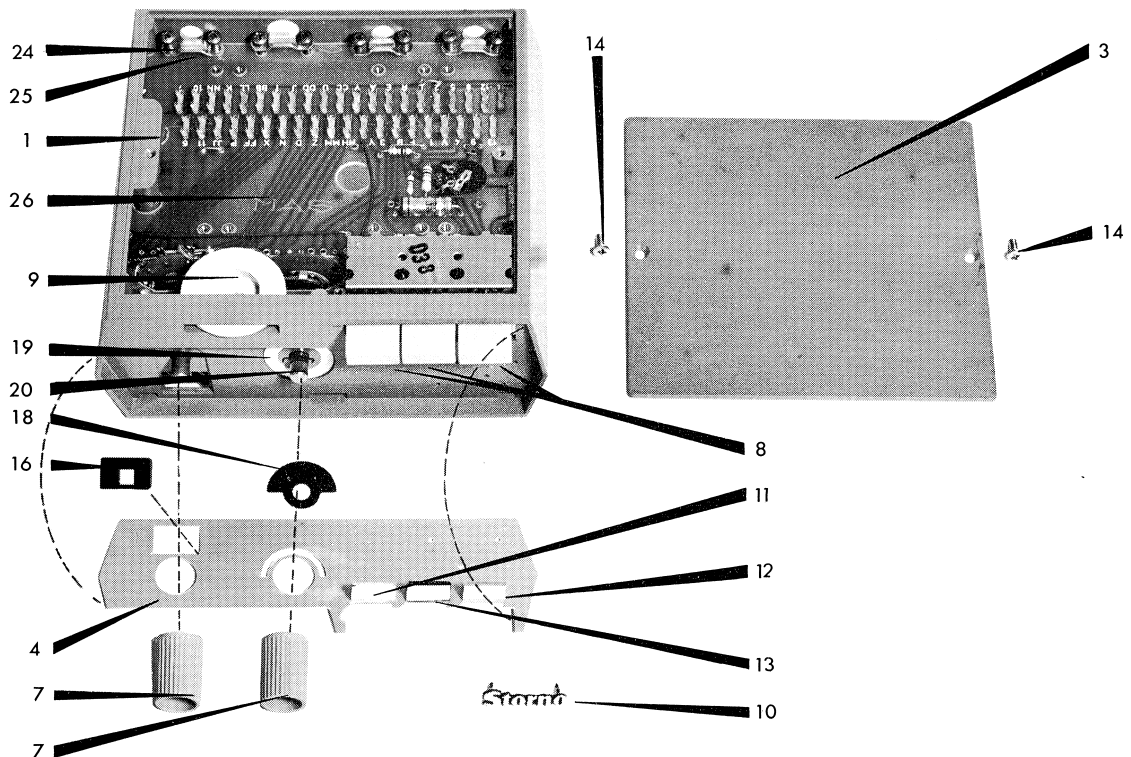
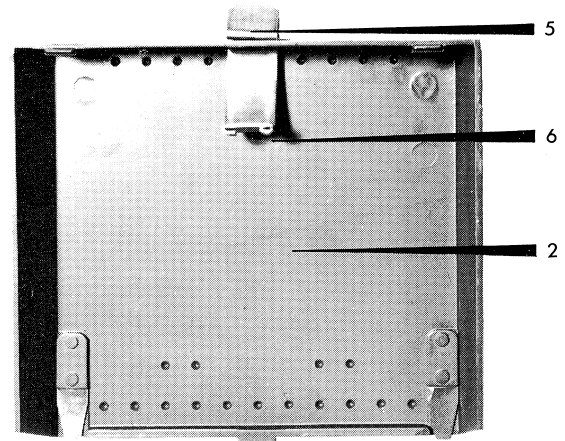
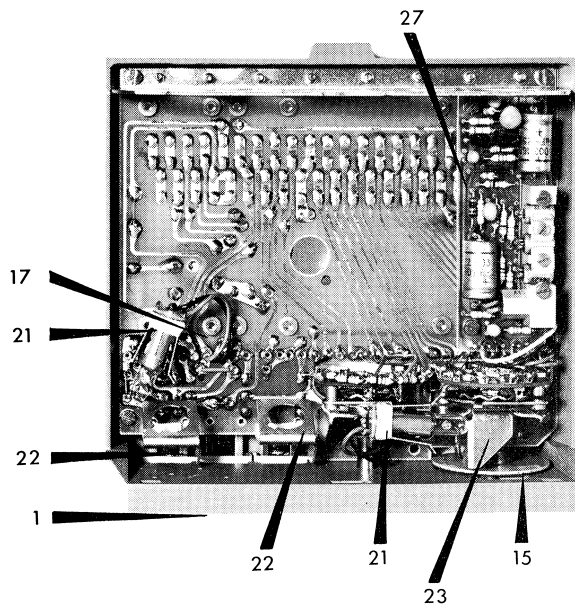
BRANCHING FILTER
DUPEKSFILTER

BF661a, BF662b

M405.007-2

Storno

Storno



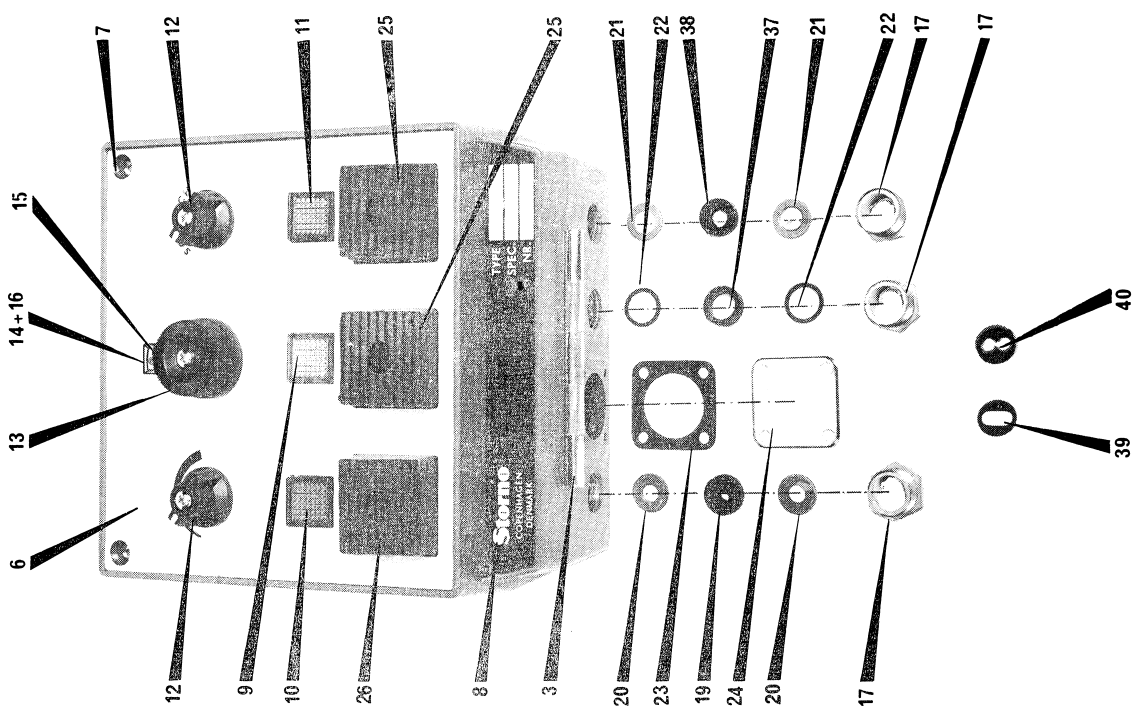
CONTROL BOX
BEDIENUNGSGERÄT

CB601

M405.003/2

ITEM	CODE	DESCRIPTION
1	12.060	Cabinet Kabinet
2	12.061	Cover Låg
3	52.023	Blanking Plate Bundplade
4	51.352-01	Escutcheon Forplade
5	36.125	Spring Clip Låsefjeder
6	33.180	Retaining Clamp Stopbøjle
7	49.111-01	Control Knob Assembly Knap, komplet
8	49.5020	Push Button Trykknop
9	86.004	Squelch Knob, Integral Part of R7 Knap med potentiometer R7
10	51.354	Motif Firmaskilt
11	48.005	Lens, Green Lampeglass, grønt
12	48.006	Lens, Red Lampeglass, rødt
13	48.007	Lens, Black Lampeglass, sort
14	21.122-030.08	Screw M3x8 Skrue
15a	50.020	Channel Indicator, Numbered Kanalvælgerskala med tal
15b	50.024	Channel Indicator, Blank Kanalvælgerskala uden tal
16	52.022	Window Piece Ramme
17	20.022-026.08	Screw M2.6x8 Skrue
18	32.153-01	Volume Scale Skala-indikator
19	32.154	Washer Underlagsskive
20	36.128	Spring Fjeder for underlagsskive
21	46.008	Lamp Holder Lampeholder
22	33.179	Lamp Holder Bracket Vinkel for lampeholder
23	33.181	Switch Bracket Vinkel for omskifter
24	20.412-029.13	Screw BZ2.9x13 Skrue
25	38.5011	Clamp Aflastningsbøjle
26	53.193-04.25	Printed Circuit Board Ledningsplade uden komponenter
27	10.1589-03	AF Output Amplifier AA602 LF-forstærkerenhed AA602

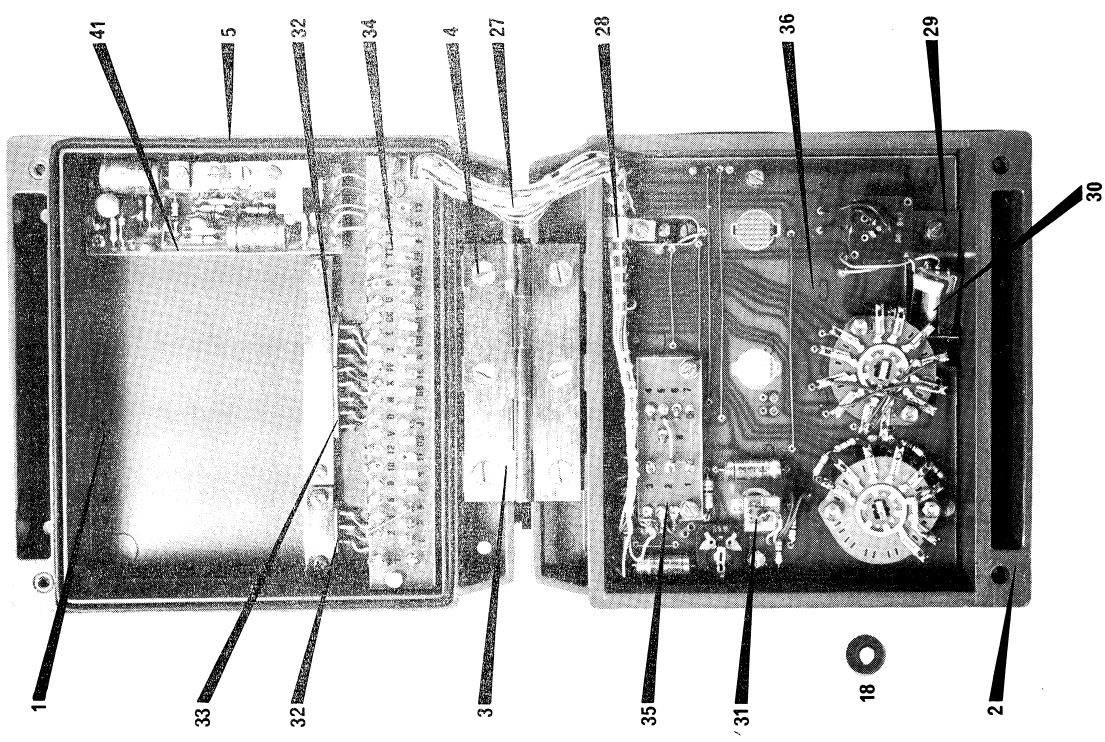
CONTROL BOX CB601



CONTROL BOX
BEDIENUNGSGERÄT

CB602a

M405.001



ITEM	CODE	DESCRIPTION
1	12.079-01	Cabinet rear part Kabinet underdel
2	12.078	Cabinet front part Kabinet overdel
3	37.093	Hinge Hængsel
4	20.041-030.06	Screw M3 x 6 (Hinge) Skrue for hængsel
5	32.092	Gasket Tætningsliste
6	51.397	Escutcheon Forplade
7	20.033-040.36	Screw M4 x 36 Skruer
8	51.480	Nameplate Skilt
9	48.5024	Lens, yellow Lampeglass (gul)
10	48.5023	Lens, red Lampeglass (rød)
11	48.5022	Lens, green Lampeglass (grøn)
12	49.081	Knob, small Knap (lille)
13	49.086	Knob, large Knap (stor)
14	50.021	Channel indicator, numbered Skala samlet
15	29.138	Window Skalarude
16	50.026	Channel indicator, blank Kanalvælgerskive u. tal
17	28.066	Threaded nipple Nippel
18	32.5001	O-Ring 5.3 ID, 10.1 OD Pakning under betjeningsknapper
19	32.209	Sealing ring Pakning
20	29.199	Washer Skiver
21	29.198	Washer Skiver
22	29.175-01	Fibre washer Fiberskiver
23	32.094	Flange gasket Gummiskive
24	29.142	Flange plate Dækplade
25	49.142-01	Push button switch assembly Trykknapp komplet
26	49.141-01	Push button switch assembly Trykknapp komplet
27	18.526	Cableform Kabling
28	38.5017	P-Clip Ledningsholder

CONTROL BOX

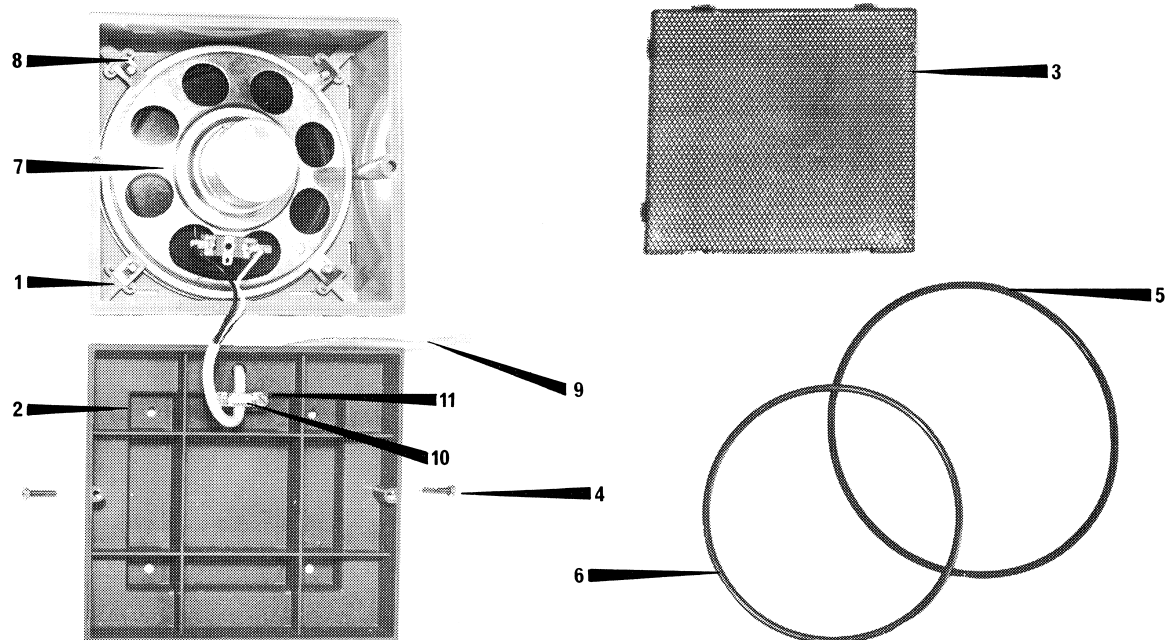
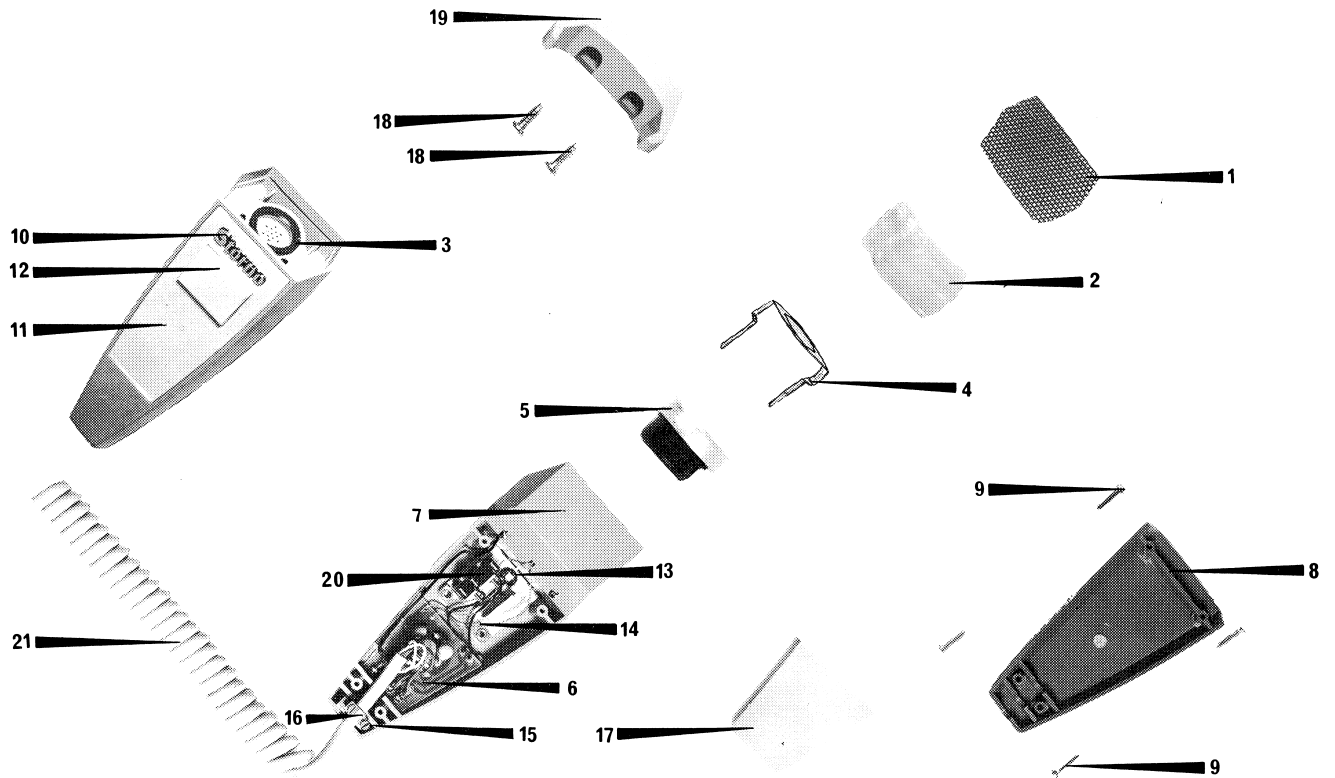
CB602a

ITEM	CODE	DESCRIPTION
29	33.230	Lamp bracket Vinkelbøjle
30	46.008	Lamp holder Lampeholder
31	46.008	Lamp holder Lampeholder
32	41.153	3 way connector, female Konnektor 3-pol.
33	41.154	5 way connector, female Konnektor 5-pol.
34	43.066	Terminal board Terminalbrædt
35	43.067	Terminal board Terminalbrædt
36	53.264	Printed circuit without components Printplade u. komponenter
37	32.157-01	Sealing ring Gummibøsning
38	32.208	Sealing ring Gummibøsning
39	29.127	Fibre washer Pakring
40	32.073	Sealing ring (battery cable) Gummibøsning

CONTROL BOX CB602a

Storno

Storno



FIST MICROPHONE MC606 - LOUDSPEAKER LS601
HANDMIKROFON MC606 - LAUTSPRECHER LS601

M405.004

ITEM	CODE	DESCRIPTION
1	12.098	Cabinet front part Kabinet forside
2	12.067-01	Cabinet rear part Kabinet bagside
3	52.024-00	Grille Højtalernet
4	20.022-030.12	Screw M3 x 12 Skrue
5	32.5025	O-Ring 109.5 ID, 115.5 OD O-ring, 109,5 mm.
6	32.5024	O-Ring 94.5 ID, 100.5 OD O-ring, 94,5mm.
7	97.5018	Speaker Højtaler
8	29.5006	Speed nut Speed-nuts
9	074.5016	Cable Kabel
10	38.5011	Clamp Aflastningsbøjle
11	20.011-030.06	Screw M3 x 6 Skrue
1-11	97.010	Speaker type LS601a Komplet højtaler type LS601a.

LOUDSPEAKER LS601

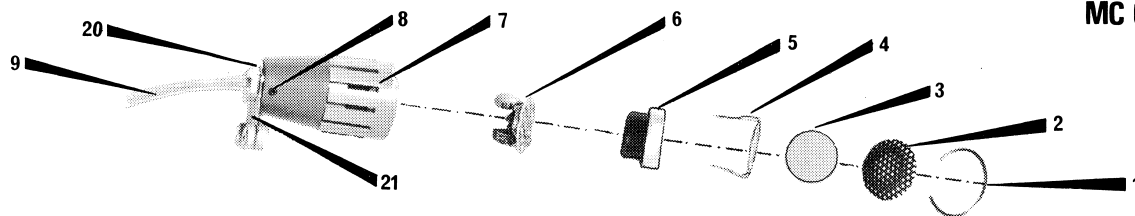
ITEM	CODE	DESCRIPTION
1	52.026	Grille Mikrofonnet
2	52.027	Dust cover Beskyttelsesnet
3	32.186-01	Gasket Gummipakning
4	37.076	Microphone Clamp Bøjle til mikrofon
5	96.5069	Microphone Mikrofon
6	10.1580	Amplifier AA606 Forstærker AA606
7	12.069	Microphone housing Mikrofonhus
8	12.068	Cover plate Bagstykke
9	20.412-0.22.13	Screw BZ2.2 x 13 Skrue
10	51.354	Motif Firmaskilt
11	51.355	Front plate Forplade
12	49.114	Keying button Mikrofonknap
13	ZA3	Retaining spring Seeger tandring
14	36.202	Spring assembly Fjeder komplet
15	20.011-0.20.10	Screw M2 x 12 Skrue
16	44.055	Clamp Aflastningsbøjle
17	32.191	Foam neoprene packing Skumindlæg
18	20.412-0.42.13	Screw BZ 4.2 x 13 Skrue
19	12.085	Microphone retainer Ophæng
20	47.5040	Microswitch Mikroswitch
21	77.5010	Coiled Lead, 6 core Snøre, 6 leder
1-21	96.074	Fist microphone, type MC606a Komplet håndmikrofon type MC606a

FIST MICROPHONE MC606

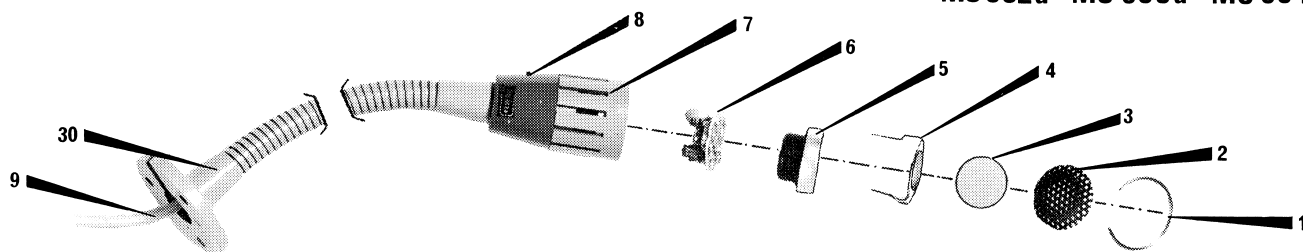
Storno

Storno

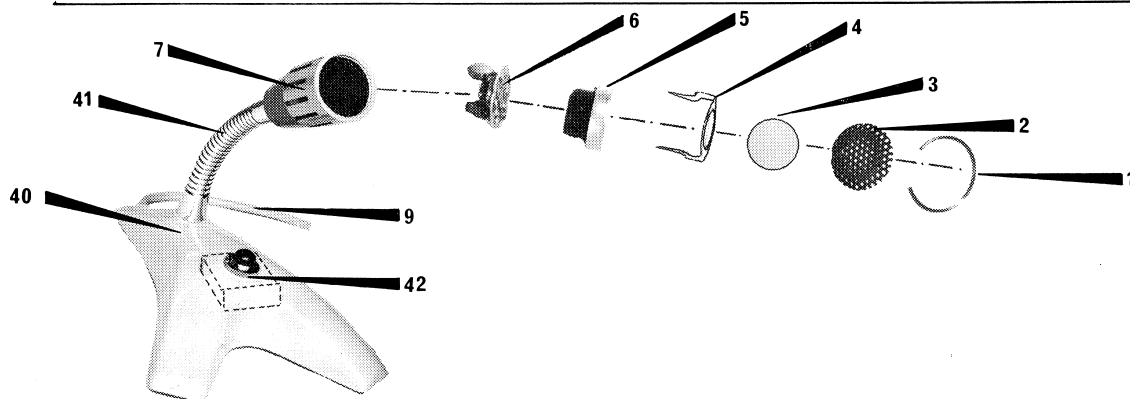
MC 601a



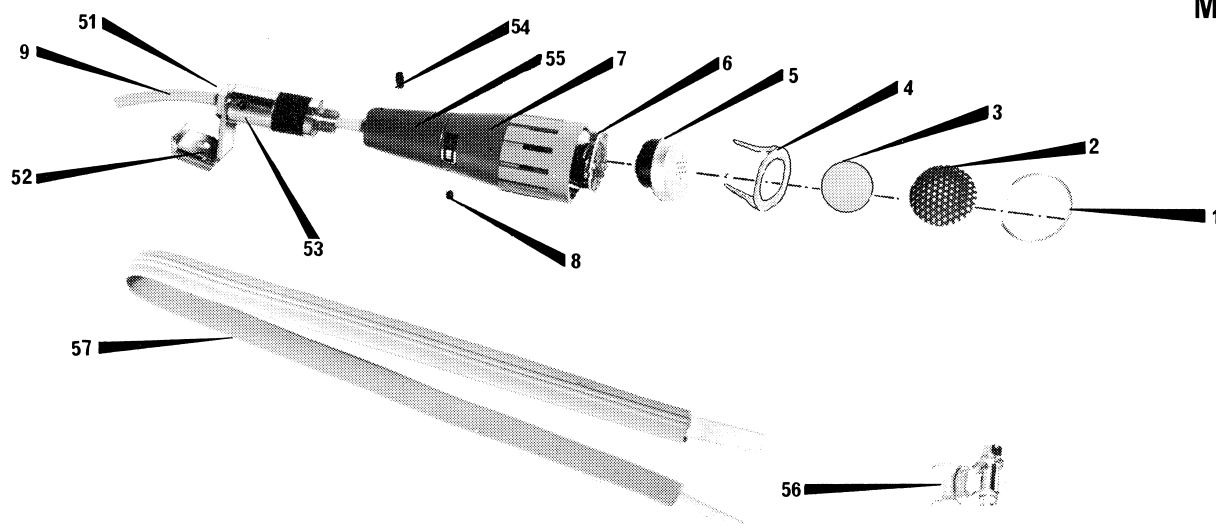
MC 602a-MC 603a-MC 604a



MC 605



MC 607



**FIXED MICROPHONE
FESTMIKROFON**

MC600

M405.005

ITEM	CODE	DESCRIPTION
		<u>MC601a</u>
	96.065	Fixed microphone, MC601a Fast mikrofon, MC601a
1	36.127	Lock-ring Låsefjeder
2	52.020	Grille Mikrofonnet
3	52.021	Dust cover Beskyttelsesnet
4	13.045	Microphone clamp Bøjle for mikrofon
5	96.5069	Microphone cartridge Mikrofonkapsel
6	10.1335	Amplifier AA604 Forstærker AA604
7	12.066	Microphone housing complete Mikrofonhus, komplet
8	20.063-030.06	Screw Unbraco skrue
9	074.5016	Microphone cable Mikrofonkabel
20	28.065	Threaded nipple Gevindnippel
21	37.092	Microphone retainer Mikrofonophæng
		<u>MC602a - MC603a - MC604a</u>
	96.066	Fixed microphone, MC602a Fast mikrofon, MC602a
	96.067	Fixed microphone, MC603a Fast mikrofon, MC603a
	96.068	Fixed microphone, MC604a Fast mikrofon, MC604a
1	36.127	Lock-ring Låsefjeder
2	52.020	Grille Mikrofonnet
3	52.021	Dust cover Beskyttelsesnet
4	13.045	Microphone clamp Bøjle for mikrofon
5	96.5069	Microphone cartridge Mikrofonkapsel
6	10.1335	Amplifier AA604 Forstærker AA604
7	12.066	Microphone housing complete Mikrofonhus, komplet
8	20.063-030.06	Screw Unbraco skrue
9	074.5016	Microphone cable Mikrofonkabel
30	37.078	Gooseneck 110 mm (used in MC602a) Svane Hals 110 mm (anvendes i MC602a)
	37.077	Gooseneck 210 mm (used in MC603a) Svane Hals 210 mm (anvendes i MC603a)

FIXED MICROPHONE
FAST MIKROFON

MC600

ITEM	CODE	DESCRIPTION
	37.059	Gooseneck 410 mm (used in MC604a) Svane Hals 410 mm (anvendes i MC604a)
		<u>MC605</u>
	96.071	Fixed microphone, MC605 Fast mikrofon, MC605
1	36.127	Lock-ring Låsefjeder
2	52.020	Grille Mikrofonnet
3	52.021	Dust cover Beskyttelsesnet
4	13.045	Microphone clamp Bøjle for mikrofon
5	96.5069	Microphone cartridge Mikrofonkapsel
6	10.1334	Amplifier AA603 Forstærker AA603
7	12.066	Microphone housing complete Mikrofonhus, komplet
8	20.063-030.06	Screw Unbraco skrue
9	074.5018	Microphone cable Mikrofonkabel
40	37.5024	Microphone base complete Mikrofonfod, komplet
41	37.5025	Gooseneck 110 mm Svane Hals 110 mm
42	47.5034	Push-button switch Trykknafbryder
		<u>MC607</u>
	96.076	Fixed microphone, MC607 Fast mikrofon, MC607
1	36.127	Lock-ring Låsefjeder
2	52.020	Grille Mikrofonnet
3	52.021	Dust cover Beskyttelsesnet
4	13.045	Microphone clamp Bøjle for mikrofon
5	96.5069	Microphone cartridge Mikrofonkapsel
6	10.1334	Amplifier AA603 Forstærker AA603
7	12.066	Microphone housing complete Mikrofonhus komplet
8	20.063-030.06	Screw Unbraco skrue
9	074.5016	Microphone cable Mikrofonkabel
51	28.065	Threaded nipple Gevindnippel
52	33.275	Microphone retainer Mikrofonophæng

FIXED MICROPHONE
FAST MIKROFON

MC600

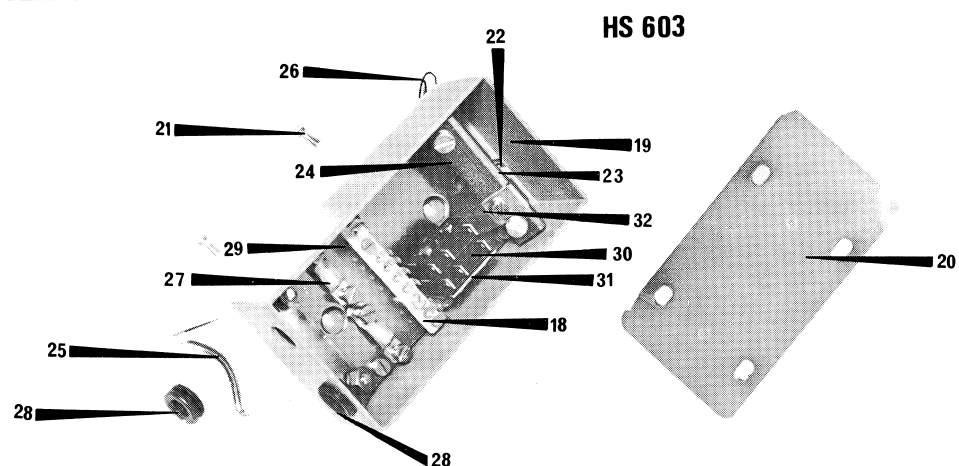
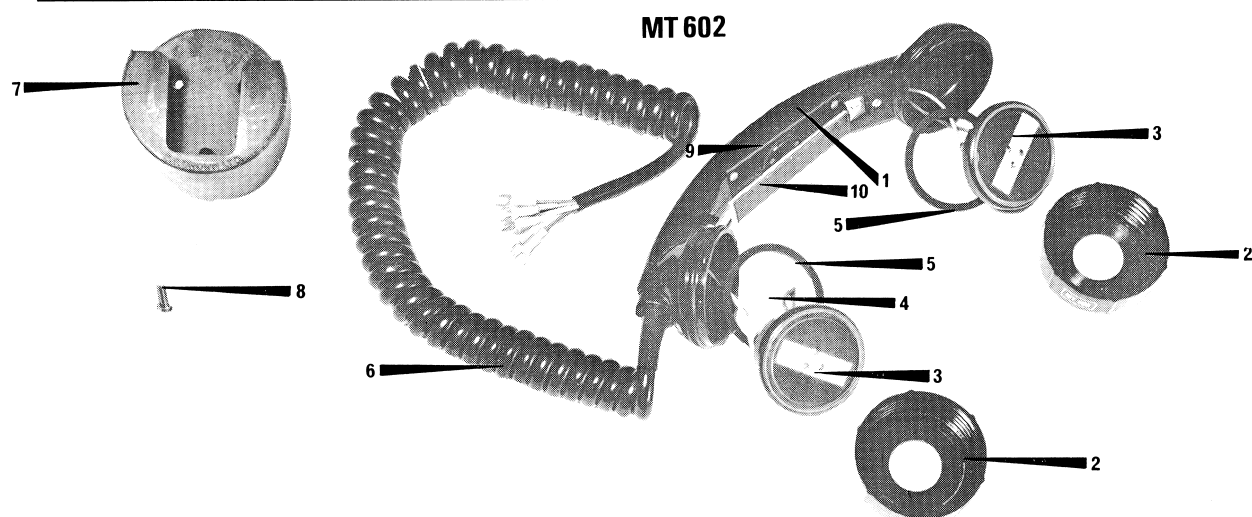
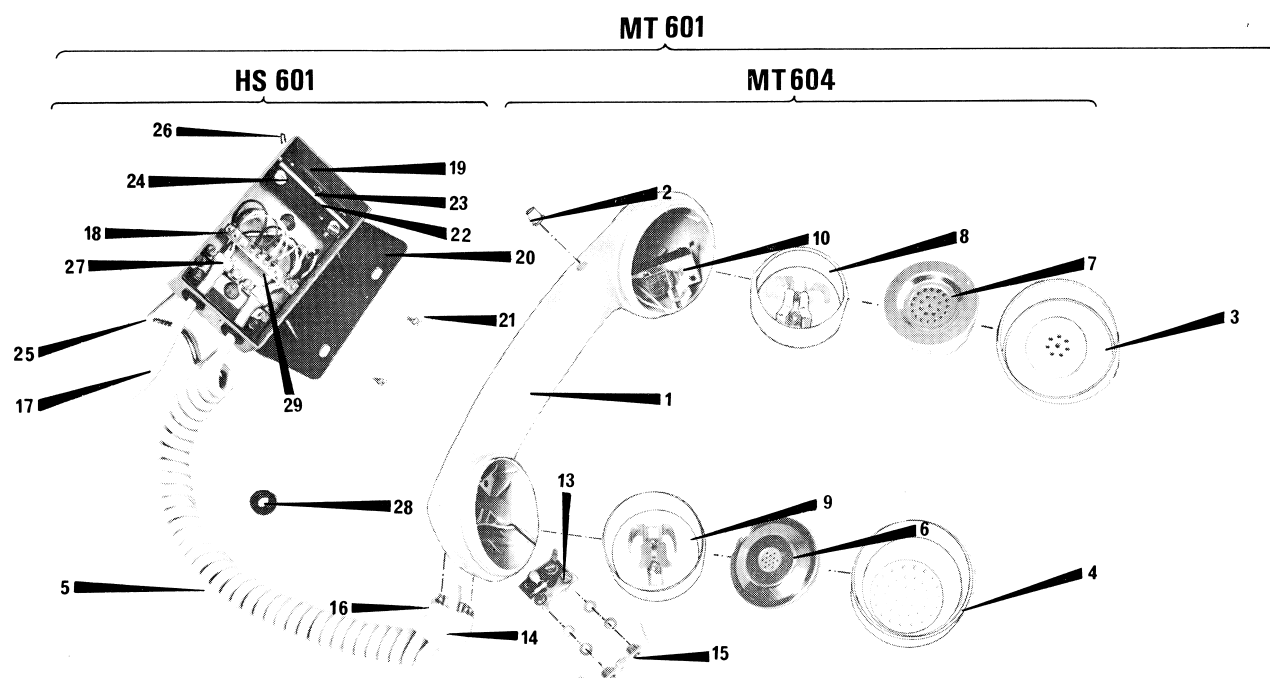
Storno**Storno**

ITEM	CODE	DESCRIPTION
53	56.5010	Vibration damper Svingningsdæmper
54	20.063-030.10	Screw Unbraco skrue
55	31.340	Bush for microphone housing Bøsning for mikrofonhus
56	37.5032	Clamp for suspension hoop Slangebinderbøjle
57	44.074	Suspension hoop Slangebånd

FIXED MICROPHONE
FAST MIKROFON

MC600

M405.005-2



HANDSET MT600 AND HANG-UP BRACKET HS600
HANDAPPARAT MT600 UND AUFHÄNGUNG HS600

ITEM	CODE	DESCRIPTION
		<u>HANDSET MT601 (Comprising MT604 and HS601)</u> <u>MIKROTELEFON MT601 (omfattende MT604 og HS601)</u>
1-16	96.085	Handset type MT604 Komplet mikrotelefon type MT604
1	96.5072	Handle, grey Mikrofonknap, grå
2	49.145	Push button, grey Trykknapp, grå
3	C39175-A1-B3	Receiver cover, grey Dæksel for telefonkapsel, grå
4	C39175-A1-B10	Microphone cover, grey Dæksel for mikrofonkapsel, grå
5	077.5010	Coiled lead, 6 core Spiralsnøre, 6 leder
6	96.5074	Microphone, dynamic 1500 ohms Mikrofon, dynamisk 1500 Ω
7	96.5073	Receiver, dynamic 300 ohms Telefonkapsel, dynamisk 300 Ω
8	C39175-A1-B2	Receiver housing complete Telefonindsats komplet
9	C39175-A1-B1	Microphone housing complete Telefonindsats komplet
10	47.5039	Microswitch Mikroswitch
11	30.5028	Tubular rivet Rørnitte
12	36.162	Spring Fjeder
13	43.053	Terminal board Terminalbræt
14	C39175-A1-C8	Cable entry Snøreindføring
15	44.057	Clamp strip Aflastningsbøjle
16	C39175-A1-D1	Cable clamp Aflastningsbøjle
17	074.5018	6 core lead Multikabel 6 x 0,14mm
18-29	37.106	Handset retainer type HS601 Komplet mikrofongaffel type HS601
18	43.061	Terminal board Terminalbræt
19	37.096	Cover Dæksel
20	11.465	Bottom plate Bundplade
21	28.077	Screw Skrue
22	36.171	Spring, left hand Fjeder, venstre
23	36.170	Spring, right hand Fjeder, højre
24	37.097	Plate Laske
25	44.062	Retaining arm, fixed Bøjle

HANDSET MT600 AND HANG-UP BRACKET HS603

ITEM	CODE	DESCRIPTION
26	44.063	Retaining arm, sprung Bøjle
27	38.5011	Clamp Aflastningsbøjle
28	32.5008	Grommet Gummitylle
29	31.329	Spacer for item 18 Stag for terminalbræt
		<u>HANDSET MT602</u> <u>MIKROTELEFON MT602</u>
1-10	96.073	Handset type MT602 Komplet mikrotelefon type MT602
1	96.5008	Handle, black Mikrofongreb
2	B101475	Capsule cover Dæksel
3	96.5006	Receiver and Microphone Mikrofon- og telefonkapsel
4	10.1506	Amplifier AA605 Forstærker type AA605
5	SD/A136969	Gasket Gummipakning
6	077.5005	Coiled lead 6 core Snøre, 6 koret
7	96.5010	Handset retainer Gummiophæng
8	20422-039.13	Screw B3.9 x 13 Skrue
9	B103101	Key switch assembly Omskifter komplet
10	SD/A13590	Keying bar Trykarm for omskifter
		<u>HANDSET RETAINER HS603</u> <u>MIKROFONGAFFEL HS603</u>
18-29		Items as for HS601 Se tilsvarende positioner for HS601 i mikrotelefon MT601
30	47.5040	Microswitch Mikroswitch
31	33.259	Bracket Bøjle
32	36.178	Spring Fjeder
18-32	37.111	Handset retainer HS603 Komplet mikrofongaffel type HS603

HANDSET MT600 AND HANG-UP BRACKET HS603